AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

Combined Boiler and Steam Pump.

The boiler and pump illustrated herewith is made by Dean Brothers, Indianapolis, Ind. The construction of the boiler will be understood from the half-section view. As will be seen the upper ends of tubes are expanded into a tube plate which is below the water line, giving what is known in upright boilers as submerged tubes instead of tubes in which the upper portion have no water in contact.

The grate is dumped by means of the knob shown above the ash-door. The base is square, with liberal ash space and hinged door. Steam can be quickly generated.

The pump is made from new patterns, with "noiseless" valve gear and valve with continuous motion. An auxiliary plunger-pump for feeding boiler is attached to cross-head of main pump. A hand lever for working pump by hand can be instantly attached.

The outfit is furnished complete, ready for work, with all parts as shown.

Lieb's Power Lap.

This machine was designed for the purpose of reducing the expense of the file account, by dispensing altogether with their use on flat surfaces.

The principle upon which it is constructed is similar to that of a buffing-wheel, the grinding material being held on the surface of a disk, by being pounded or pressed into the soft metal of which the disk is made.

The metal which holds the emery, crocus or other abrading material, is something like babbitt-metal, and upon the peculiar properties of this metal depends the efficiency of the machine.

To prepare for use, the grinding powder is sprinkled over the surface of the disk, a heavy conical roller is held on the disk, which is rotated until the grinding material is pressed into the surface of the disk. A surface plate, so mounted on a stand that it will revolve easily, is kept, at all times, beside the lap.

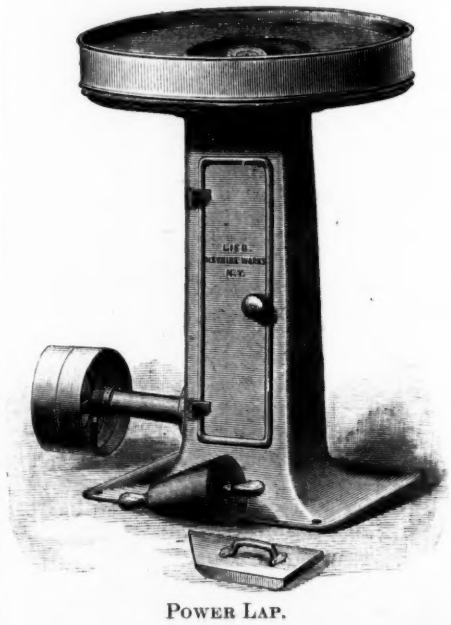
When a surface is to be made on a piece of metal—it may be brass, iron, steel, copper or any other metal—it is held on top of the revolving disk, and at the same time it is moved back and forth, to avoid grinding in one place.

The work is tested by rubbing on the surface plate, which is also covered with some of the polishing powder. Care is needed when testing work upon the surface plate, to keep the wear distributed by occasionally rotating the plate, and rubbing all parts of its surface equally.

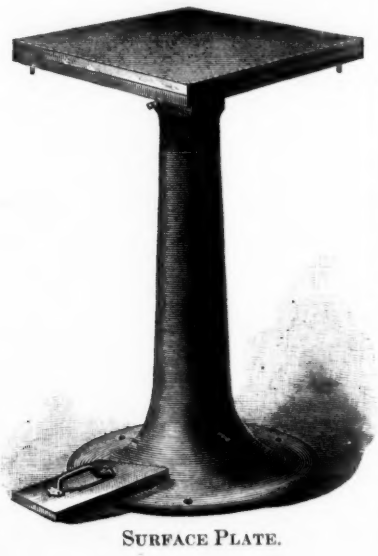
When the grinding powder is worn out, or is to be changed, the disk is washed with soda and water, which removes all grease, as well as polishing powder.

As the velocity of the disk is greater at its outer edge, it will grind faster at that place. This peculiarity is made of use in practice, by using it to grind away faster any particular part of the work.

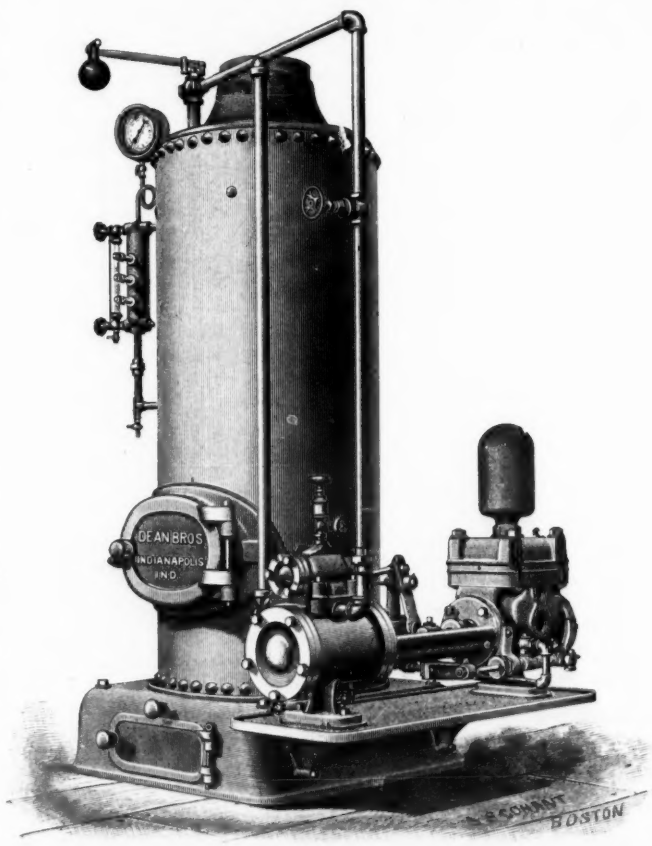
These machines are manufactured by Lieb Machine Works, 27 Vandewater street, New York.

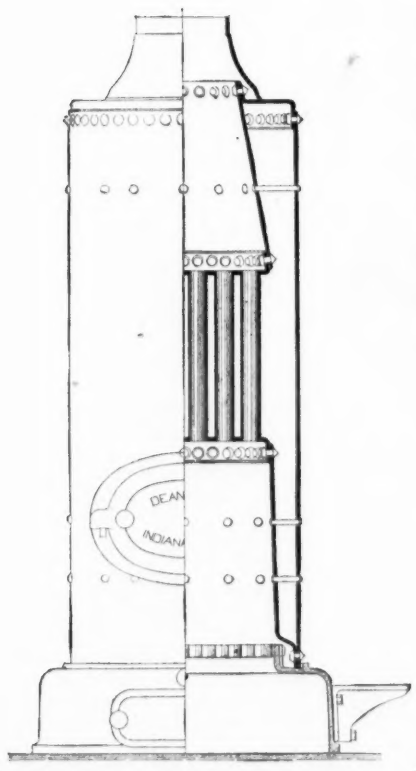


POWER LAP.



SURFACE PLATE.





COMBINED BOILER AND STEAM PUMP.

A good deal of complaint is heard from Manayunk, Philadelphia, in regard to the action of the authorities with reference to drainage. The mill owners are very properly prohibited from connecting drains, or using those already connected, with the Schuylkill River, from which water for use by the city is obtained. At the same time no other means of draining is provided. The city is building a large sewer, but this is far from being completed. Philadelphia is not the only city that has made mistakes of this kind. Nothing is more important to the manufacturing interests of a city than that they should not be hampered by things of this sort. Plenty of water, and facilities for drainage are necessities; when they are not provided, manufacturers are likely to look elsewhere for a location.

The institution of societies of nearly all kinds of workers for mutual improvement is an encouraging sign of progress. A large amount of knowledge is made common in this way, and the tendency is towards general improvement. This is an absolute requirement of the times.

Inventory Valuation of Patterns.

BY EWING MATHESON, M. INST. C. E., LONDON, ENGLAND.

I have read with interest in you journal an article inviting discussion on the Inventory Valuation of Patterns [AMERICAN MACHINIST, Jan. 9], and as I have had occasion to investigate this subject in connection with iron foundries and engineering factories in this country, I venture to trouble you with a few words on the matter.

One of the difficulties in valuing patterns arises from the very different significations of the term "value." Thus there is the valuation which parties may prudently make in their annual accounts before reckoning their profits, and there is the value which might properly be given to the patterns in the event of the business—while in the full tide of successful working—being sold or transferred. Patterns worth in earning capacity $1,000 may, if sold by auction, fetch $50; while on the other hand it would be wrong to credit the estate of a deceased partner with only the lower value. In England the difficulty is sometimes met by opening what is termed a suspense account for those patterns which have been made with a view to future as well as present castings. The full value is "written off" in from two to ten years, as may appear appropriate, but in case of the sale of the business or dissolution of partnership, the suspense account is reinvestigated and the present value arrived at by agreement or arbitration. From what I have seen of American factories when I have visited them in prosperous times, it appears to me that the profits were so much better than here that there was not the need which we encounter in England of analyzing closely capital accounts and allotting all expenditure with precision. Here the narrow margin between profit and loss renders very close attention necessary, and the keeping of factory accounts has become a science.

From a little book I have published on the Depreciation of Factories and of which I believe some copies have been sold in the United States, I extract the following which may be of some interest to your readers in this respect:

"Foundry patterns may be taken as a type of the patterns or designs necessary in so many trades, and involving much cost not easily dealt with in the books of account. As a safe general principle or starting point, every casting or set of castings should pay for its pattern, and where some exceptional or peculiar shape is to be made, with no immediate prospect of using the pattern again, this is necessary if loss is to be avoided. There is a natural reluctance to break up costly patterns, and an equal reluctance to treat them as valueless. The storing of them is often continued for many years without return and ultimately the patterns are broken

up for firewood or scrap iron, as the case may be. Much depends on the nature of the trade, whether of a repetition or miscellaneous kind. It is often expedient in a repetition trade, where a succession of orders may be reckoned on, to spend much more on the patterns, which may have a value many times that of the castings made from them in the first year. Even, however, if durable iron patterns have been made, they often become obsolete before worn out, and therefore should be quickly depreciated.

"Toothed wheel and pulley patterns may be said to have a permanent value, but since the introduction of wheel moulding machines it is much less common to store such patterns. Many expensive patterns, especially of an ornamental kind, have a value quite dormant, because they are unknown to purchasers, and it is for this reason that the publication of illustrated catalogues may give life to a stock of patterns, otherwise useless. But while this may extend the time over which the cost is to be distributed, the value should generally be written down to one-tenth of the cost in ten years. If not used often they have little value; if used often they soon wear out.

"Copyright designs or patterns protected by patent may, of course, have a special value, but, as between partners, this should be written off rapidly, as such rights last only a short time. In the case of a change of ownership a new valuation should be made. In this category should be included the engraving blocks used for catalogue illustrations.

"The value of plant, as shown in the capital account of a factory which has been successfully managed should be less than the real value to a new comer, who is to continue the business. Depreciation, as treated in the accounts, should not only balance the mere wear and tear, but provide for contingencies, and although partners, as between themselves, may have prudently written off on this basis, yet if, when the property is transferred, these contingencies have not occurred, the future risks no longer concern the sellers, who may justly retain what has in effect been an insurfance or reserve fund. For instance, the value of patterns and other accessories may have been written down to little or nothing, because of a possible cessation in their usefulness, but if these accessories are still in use, the value to a new comer revives, and a new departure may be taken in the way of depreciation."

Teaching the Hand.

"What shall our children do when they leave school?"

This is a question which has long been pressing upon parents for an answer; it is a question which the grown children have had to solve for themselves later; and it has now forced itself upon those who have accepted the responsibility of directing the youth of our land.

For years this problem in the prevailing system of education has forced itself on Mr. S. M. Inman. He soon came to the conclusion that the fault was not in the studies pursued in our institutions of learning, considered in themselves, but in the failure to combine practical with literary education. Add the study in a practical way, of the mechanic arts to the curriculum, and we should have on graduation day, not only a class of finished scholars stepping into the arena of life, but a class of young men who have already developed the talent for some of the various branches of wook work, of iron work, or of the other pursuits out of which a living can be made.

These, by the *Atlanta Constitution*, were made at the instance of an inspector of the Atlanta, Ga., University, by a committee appointed to investigate the matter in relation to introducing manual training in the public schools of that city.

C. C. Tucker, who has charge of the institute, stated that the attendance upon the industrial class does not interfere with the other college studies, but merely takes its place as one of them. The scholars are divided into three classes, one of which has twenty-four members, the second fifteen, and the third thirty-two, being graded according to proficiency just like the literary classes. The class exercise lasts one hour and a half, being four hours and a half in all. This arrangement serves the double purpose of filling in the day's exercises in the industrial room, and yet of keeping each scholar only one and a half hours from his other studies.

"Does this work attract attention from the literary studies?" asked Commissioner Smith.

"It rather serves as an incentive," replied Prof. Chase. "It is a relaxation from mental studies, and sends the scholars back to their classes brightened up and ready to do such vigorous thinking that the time after all is not lost, but serves as a recess.

By this time the party had entered the building, where Mr. Tucker stood ready to receive it.

"We only teach the elementary principles of wood work," said Mr. Tucker, under the rigid cross-examination of Commissioner Smith. "You see there are certain elementary principles which underlie all wood work which, when mastered, enables the scholar to choose for himself the trade he wishes to learn. Here he follows the bent of his mind, and can make no mistake in after life as to his occupation. In iron work, also, there are elementary principles which underlie every line growing out of the use of metal. The tools, also, are the same, in fact, the variations being merely for special adaptation to special lines of work. This is true of all other lines of industry. Thus you will see that the pupil, serving his regular class time here by the time his three years' course is finished has not only completed his literary education, but has developed at the same time his special aptitude for some line of trade, and is thus saved the apprenticeship he would otherwise have to serve. At present we are only engaged in wood work, in which we have been so successful that the iron department will be added shortly.

"Do industrial schools gain anything from being located near manufactures?" asked Commissioner Smith.

"It adds to their value tenfold," answered Mr. Tucker. "Here we teach the science of the work, with enough of the practical manipulation to make the scholars familiar with the use and care of tools. With large factories near around, the class could be taken out twice or thrice a month, and by inspection of the actual work, greatly supplement what they have learned here. The factories around Atlanta would be of such value to scholars that it could not be computed by a money value. It is a good thing to be near the shops."

"Let me give you another point," said Professor Chase, as the party walked back to the main building. "Last summer, during vacation, many of the university scholars, instead of teaching school or looking to the learned professions, went to work at the different trades for which they had developed a talent in our industrial school, and came back with more money than the school teachers. You see it turns their minds to work."

"This is a great success," said Mr. Roffe, as he wiped his hands with his apron. "We familiarize all these boys with the use of tools, the manipulation of wood and iron, and the general principles which underlie the mechanic arts.

"We have now thirty boys, and have applications which we cannot accept. Most of these boys are shopboys who come up here to learn the principles of the trades which they are learning. It is our plan to familiarize our students with wood and iron, so that they will readily find out the trade for which they have a talent. Another point about the school is that the bright side of the trade is presented.

"When a boy enters a machine shop, he is at first put to cleaning off grease, and such other work as disgusts him with the whole business. Here we put him at the lathe or bench at once. He goes to work with enthusiasm, has a pride in his surroundings, and will develop into a good and self-respecting workman. Thus we help to form his character as well as to instruct him."

"A more willing and intelligent-looking set of workers was never seen. Such scenes, repeated in every town of Georgia, would add brawn to the arm, wealth to the purse and cultivation to the brain.

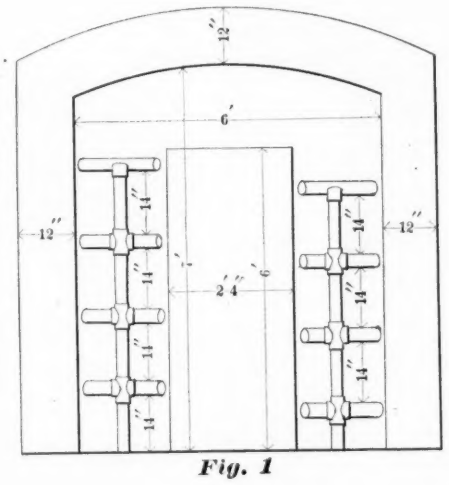


Fig. 1

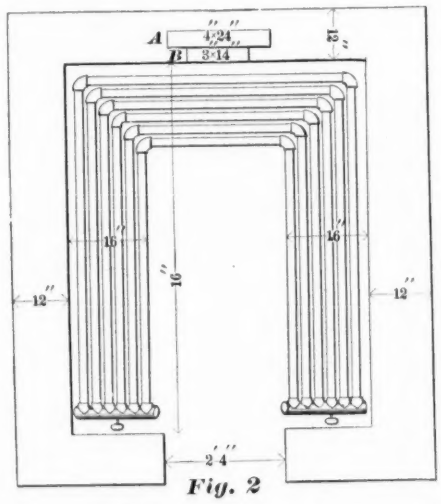


Fig. 2

STEAM HEATED CORE OVEN.

Steam-heated Core Oven.

BY ROBERT E. MASTERS.

There are comparatively few foundries that dry their cores in ovens heated by steam, and the trade generally will appreciate the valuable information furnished by E. E. Baker, manager Haxtun Steam-heater Co., Kewanee, Ill., and Wm. Cunningham, foreman of their foundry in answer to an inquiry (suggested by Professor King, of the Wisconsin State University) in the AMERICAN MACHINIST Nov. 7th, 1885.

I inclose tracings of section and plan views of the oven furnished me by Mr. Baker, which are so complete that very little description is necessary. Fig. 1 is a sectional view; Fig. 2 is a plan view, showing the arrangement of the pipes, ventilation, etc.

They have six of these ovens, four of them six feet wide and two eight feet wide, situated a distance of 150 feet from the boiler-house. The steam is conducted through $1\frac{1}{2}$" pipe from boiler-house to core ovens, and an average pressure of 80 pounds of steam is kept up. The shelves for drying cores are composed of 1" pipe. There is a separate valve to each oven, so that the heat can be shut off in any oven, leaving the rest heated. The pipes have a 3" slant on each side, making one side 6′ lower than the other, as shown in Fig. 1. This is for the drip.

They have had no occasion to put their oven to a test to see how large a core they could dry. For their own work they require cores up to 12" in diameter, which are put in the oven in the forenoon, and are ready for use the next morning. If in a hurry through the day for cores 2" or 3" square, they are ready for use in an hour and a half after puting in the oven. In Fig. 2, *A* is the flue and *B* the inlet from oven into the flue.

Mr. Baker says: "The size of the ovens can be varied to suit the kind of work required. Where they are arranged two or more together, we build the ventilating flue in the wall between the two at the back end, so that one flue serves two ovens. The ventilation in this kind of an oven is one of the most important features, as without it nothing can be dried."

In an oven, as shown in the tracing, with the amount of pipe that we use, we are able to get a temperature of about 260 degrees on the upper shelves; of course, the lower ones do not get as hot. The openings in the ventilating flues are at or near the floor below the bottom row of shelves. We have no opening for supplying fresh air, as we find that the doors, as usually constructed, will admit all that is needed."

Mr. Cunningham says: "The chief advantage in drying cores in steam ovens is that when you leave your cores in the oven for any length of time, there is no danger of burning the corners off, and any small projection on a large core is not injured or liable to crumble away, as when dried in ovens heated by fire: for instance, we can dry cores 12" diameter and $\frac{1}{2}$" diameter in the same oven and on the same shelf, and leave them both in until we get ready to use them, whether it be one day or three weeks."

There is one thing that suggests itself to me in relation to this oven; that is, the advisability of making the walls hollow to save heat. With the great difference in temperature as between the inside and outside of the oven, especially in winter, it appears to me the hollow wall would effect a material saving. I do not offer this as in any sense a criticism on the very excellent arrangement shown.

Early Engineering Reminiscences.

BY GEORGE ESCOL SELLERS.

TWENTIETH PAPER.

For a few days before the closing of the Chicago Railway Exposition, there was exhibited an original colored drawing of the locomotive Essex, built in 1837 and 1838 by Mr. Seth Boyden, of Newark, N. J. This drawing was not made by Mr. Boyden, but was represented as having been made from the engine by the engineer who first ran it. In the *Railway Age* of July 26th, 1883, there is a good wood-cut made from this drawing that shows the general arrangement of the engine, accompanied by a partial description and some notes of Mr. Boyden, as an inventive mechanic, which he richly deserves, for he was an original thinker, in advance of the time. That I may throw some light on the history of the only three locomotives that he ever constructed, the Essex being the first, I will make some extracts from the notice above referred to:

"This locomotive and two others were built in 1837 and 1838 by Seth Boyden, in Newark, N. J. At that time the subject of steam locomotives was in its very infancy, and never before had it been attempted to build them in New Jersey, so this becomes important as a matter of history, that Seth Boyden built the first locomotive in a State that to-day can boast of as fine and large locomotive shops as any in the United States.

"In 1836 Seth Boyden, who was always laboring to out-think his neighbor, contracted with the Morris and Essex Railroad Company (now known as the Delaware, Lackawanna and Western Railroad) to build two locomo-

tives to run between Newark and Madison, N. J., and he accordingly went to one of the most important manufacturing towns in the New England States and requested four mechanics, Henry L. Brown, Cyrus Currier, Parley J. Perren, and a Mr. Kitridge, to go with him to Newark to work on the new locomotive.

"These locomotives were built in 1837-8 and were named, Essex and Orange. They possessed many practical features, many of which are embodied in all the locomotives of to-day.

"Mr. Boyden was the originator of the outside horizontal connected engines, and although the English still adhere to the inside connection, the practice in this country is in accordance with Seth Boyden's system.

"One of the comments made by a party of experts who came from New York, Paterson, N. J., Philadelphia and other places, to examine the engines just before their trial trips, was that with outside connections they would be likely to jump the track. Mr. Boyden thought if that would do it the sooner they jumped the better; but the experts were wrong, for those two locomotives did long and good service, and in the language of one of the engineers who used to run them, they were "as smart as a whip."

My earliest recollection of Mr. Boyden was about the time he was introducing his patent leather. At that time he came to Philadelphia to see a leather-splitting machine that my father had invented, and had in daily use. I do not know when their acquaintance and intimacy commenced, but I do know that it lasted until my father's death, which occurred in 1834. I recollect that my father frequently spoke of Mr. Boyden as a sound mechanic; a man of original thought, a most prolific inventor.

The leather-splitting machine that I refer to was for equalizing the thickness of calf or kip skin for machine cards, without torturing and twisting it out of shape as was the case when drawn against the edge of the splitting knife by being wound on a small roller. This my father accomplished by a solid cylinder or roller made of marble, having a circumference greater than the longest leather to be equalized. The wet leather, in strips a little wider than required for the card to allow of trimming, was secured to the cylinder by points in a groove set sufficiently below its surface to pass under the splitting knife without interfering; as the marble cylinder was turned under the knife, the wet leather pressed to it immediately in front of the knife by the ordinary spring straight-edge would hug to the cylinder, and pass through perfectly straight; a considerable portion of the shavings or splits, were valuable for boot stiffeners and other uses, that previously were lost by the usual currier's shaving. With this Mr. Boyden was much pleased, for he believed it would be practicable to get two sheets out of the common kip skin thick enough for japanning. It was not many months before he sent specimens. The whole size of the skins less the skirtings, had been split into three, all beautifully japanned and highly finished.

The idea of japanning leather was not original with Mr. Boyden, for at the time of small clothes and fair top boots, it was as common to see the exquisites of the day claying their boot tops, as it was to have an immaculate black polish to the feet and legs, until there came from London patent white or buff-japanned leather for boot tops on which a damp sponge and soft dry cloth took the place of the clay cleaning. Mr. Boyden's invention, or rather discovery, was in the japan that would give the intense black hardness with high polish and sufficient elasticity at so low a temperature of the ovens as not to injure the leather. Years later he explained this fully to me, and showed the memoranda of the immense number of experiments he had made before he had succeeded. This leather-splitting machine I never saw, but his letters to my father at the time explained his substituting a moving table for the cylinder, various experiments as to the mode of holding the leather firmly to it, and to the edge of a quickly vibrating splitting knife.

Mr. Boyden is well known as the father of malleable iron castings, of which he made an entire success, and afterwards his great invention of manufacturing felt hat bodies by machinery, over which patent there was a long and bitter contest against a powerful combination. He resorted to the novel expedient of exhibiting his machine at work in the presence of judge and jury, and finally sustained his rights.

I have made this digression to show the versatility of Mr. Boyden as an inventor. I have heard him say the hardest work of an inventor was to discover what was wanted; that once established all was easy, or, as he expressed it, "plain sailing."

To return to the locomotive Essex, and its mates. Previous to his entering into the contract to build the two engines above referred to he came to Philadelphia, bringing with him a movable card model of his proposed valve gear, in which he took the motion from the crosshead. He laid great stress on the importance of quick opening and closing of steam ports, so adjustable as to take the greatest advantage of using the steam expansively. I do not recollect the details of his arrangement. It was in a measure anticipating the present link motion. This model was so made that by moving the piston the position of the valve was shown. Baldwin at that time was confined to engine cylinders of from 10½" to 12" diameter and 16" stroke. My brother and myself were using 10" cylinders by 18" stroke. Boyden proposed using

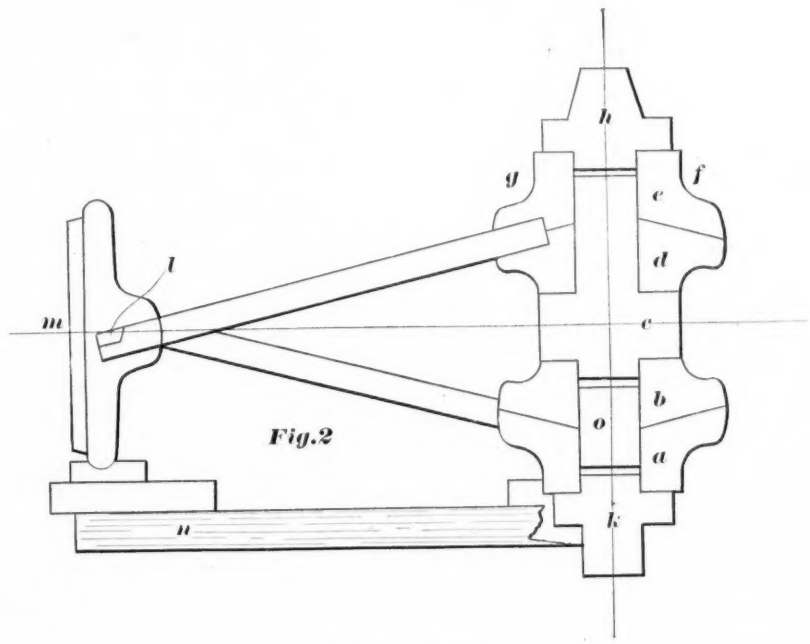


Fig.2

TRACTION WHEEL.

8" diameter cylinder by 30" stroke with his adjustable cut-off, and he insisted on it that we were all wrong in the short stroke. He had made drawings to use Baldwin's half-crank to get width of fire-box. He had been to Messrs. Vail & Son, Morristown, N. J., to inquire about tires, and some heavy iron work, and had learned from them that the half crank was patented, and at the same time that we had outside attachment engines successfully running on the Pennsylvania State road; this brought him to Philadelphia.

He stated to me that before calling on us he had seen Mr. Baldwin, had tried to interest him in long-stroke engines, with his valve arrangement, and that Mr. Baldwin had declined to sell the right to use his half-cranks on the engines he had agreed to build for the Morris and Essex Railroad. He had many questions to ask about steadiness of the outside connected engines on the road. We at that time had two on the State road, one of which had been in daily service over a year. One of his questions was as to patents covering any portion of our engines, saying he would rather abandon building, and demonstrating the value of his hobby—expansive steam in long-stroke cylinders. I took him to our shops, showed him two engines then on the floor, that but little was being done on, as we were driven to our full capacity on the contracts we had taken to build the steam engines, rolling mills, milling machines, ingot moulds, and melting and refining furnaces for the branch mints at Charlotte, N. C., and Dahlonega, Ga.; also remodeling the melting and refining departments of the mints at Philadelphia and New Orleans.

I could not take the time to go with Mr. Boyden to the shops of the State road. I gave him a letter to John Brandt, who took him over the road on the platform of one of our outside connected engines. On his return he expressed himself as perfectly satisfied as to safety and steadiness of running. He had much to say as to the advantage he should gain in adhesion by placing his driving-wheel axle close to the fire-box. I do not know what took place between him and Brandt, but I was surprised at his saying, he had decided on 8"×24" cylinders, and he laughingly said, that "6" over us and 10" over Baldwin was probably as much as it was safe to venture, but he believed the time would come, when the economy of fuel would demand it; that three feet stroke even if gearing had to be used, would be adopted; such was his faith in cut-offs and expansive use of steam, and when he had worked out a problem to his own satisfaction in his mind, there was no changing him. All the three engines he built had cylinders 8"×24" stroke.

The third engine he built was not taken by the railroad that the two first were built for, and he took it to Cuba. The last time I saw Mr. Boyden was shortly after his return from Cuba. He then spoke hopefully of the success of what had taken him there. He had invented and used for a long time a system of furnaces for burning wet tan, the heat of one chamber drying the tan in the adjoining one, the escaping gases from which were ignited in a combustion chamber common to all the separate tan chambers. There were no grates, the tan being burned from the top. Mr. Boyden had, through a Mr. Hollibird, of Cincinnati, essayed to introduce his system of furnaces for burning and generating steam by the wet bagasse, as it came from the rolls of the sugar mill (the same as he had burned wet tan) in Louisiana. Mr. H. had only made it practically successful; hence his experiments in Cuba were under his own management.

If Mr. Boyden was now living he would be the last man to claim outside-connected engines as his system. As I have stated in a previous paper, I never claimed it as an invention, but the battle for the practical introduction in our American system of locomotives devolved mainly on me, all of which Mr. Boyden was fully aware of, and having ridden on an engine that had been in successful use for over two years before his first engine was turned out, he was perfectly safe in assuring the experts "that it would not jump the track; if it did, the sooner the better."

At a meeting of the Detroit (Mich.) Association No. 1 of Stationary Engineers, held January 9, 1886, James D. Anderson, of 38 Clinton street, was elected recording and corresponding secretary.

Pattern-making.

BY F. W. BARROWS.

TRACTION WHEELS FOR FARM ENGINES.

These wheels are sometimes to be made in such a way that the castings need no finish, even the hole for axle being left in the rough. Of course the casting must be pretty smooth and true in order to be complete as it leaves the foundry or cleaning room. To get a smooth, true casting it is necessary first to have a good, accurate pattern, for I never saw a nice casting made from a poor pattern.

Let us construct a wheel like the sketch given, which is a section of a wheel showing the arms. One of the treads or teeth to prevent slipping, is shown at *m*. The figure shows the hub in detail. It is evident that the hub must be in two parts to admit of drawing one set or row of arms; then removing the sand between the two rows of arms, and finally removing the remaining part of hub with its arms.

It is also to be so put together that the core through hub will always come in the center of wheel. No finish, you know. The hub must also stand true with the rim, so that the wheel will not *wobble*. In short, the pattern must be made about perfect, and this is the way I adopted to secure the desired end: The rim is to be laid up first and should be parted at the center both inside and outside, for reasons given further on. Saw up the stuff for arms and let it be getting into some permanent form. Get the stuff for the hub out as follows: *a*, *b*, *d e* to have the grain running from *f* to *g*; *c* to have the grain running from *h* to *k*, and long enough to reach through the whole hub as shown. Turn *c* with a pin on each end, then turn the other parts of hub to fit over pin and with the joints between *a b* and *d e* on the line of center of arms.

The arms should be long enough to reach from outside of tongue *l* on rim to the hub and into it about 2". Fasten *c* and *d* together and then putting the other parts of hub together by means of the pins on *c*, lay out the holes for arms and work them nearly to the size; also lay out and cut the arms into rims, taking care to get every one in line at the point where they enter rim, and slanted up and down alternately.

Now chuck the nowel side of rim on a large chuck; on the same chuck fasten part *a* of hub at the right distance from the center joint of rim, all as shown by the portion of chuck *n* in figure.

Then fit in the first row of arms, letting one end just touch and clear in the rim; glue them into the part *a* driving a small nail or screw through each one to retain it in position. Now fit down *b* and fasten it with glue and screws between the spokes; next put *c* and *d* in place, and fit in the other row of arms. Great care should be taken in fitting and fastening both sets of arms, as upon these depend the position of hub and core for axle. After fastening the arms and putting on *e* the other half of rim may be fitted down.

Remove from chuck and test the centers by a pair of trams. If you have done your work accurately the centers on *c* made by the lathe will be exactly central with rim, and the arms will not spring in all directions so as to require a boy to hold each one in place while moulding. The pins on *c* should be cut off as shown in figure. Glue the piece *o* into *a* and *b*, then turn up the two ends of hubs *h* and *k*, which form a shoulder for the wrought-iron bands usually shrunk on, and also form the core prints as shown.

The projections on rim, shown in section at *m*, may be moulded on the wheel if their shape will permit it, or may be made in cores and rammed up in mould against rim. The best job is made by moulding on, then it will be found, if the rim is parted in the center, it will make less work fitting these on, as both sides will be alike. This will be quite an advantage if they stand at an angle, as they often do.

At the recent trial of a torpedo boat, built in England for the Austrian Government, a speed of 27.66 statute miles was attained as the mean of six trials.

Modern Locomotive Construction.

By J. G. A. Meyer.

EIGHTEENTH PAPER.

ROCKERS.

Figs. 83 and 84 represent a rocker, such as is used in American locomotives. The general practice in locomotive construction is, to make the rockers of wrought iron, although occasionally we find them made of cast iron. The arms and the shaft are forged in one piece. The holes in the end of the arms should be tapered, the taper being equal to $\frac{1}{8}$ of an inch in 12 inches; that is, in a hole 12 inches deep, its diameter at one end should be $\frac{1}{8}$ of an inch larger than the diameter at the other end. Some makers adopt a greater taper, sometimes as great as $\frac{3}{4}$ of an inch in 12 inches. The pins are made to fit these holes very accurately, so that they must be driven home with a hammer. The pins are made of wrought iron, and are case-hardened.

The reason for making the holes in the rocker-arms tapered, is that the pins can be driven out with greater ease, and without injuring or upsetting their ends. On the other hand, if these holes have no taper, and the pins fitted into the former as firmly as is required in a locomotive, then the pins will need so much hammering in driving them into or out of the holes, as to produce injurious result.

The design of the locomotive generally limits the length of the rocker-shaft between the arms, but when there is room enough, the length of the rocker-shaft should be at least 12 inches for large locomotives, and not less than nine inches for smaller engines. The diameter of the shaft must be such that it will have sufficient strength to resist the severest stress to which the rocker may be subjected without springing or twisting the shaft to any appreciable extent.

The greater stress to which a rocker can be subjected will occur when an engine is to be started after it has been allowed to stand still for some time, for the following reasons:

1st. When an engine is to be started after standing still for some time, the valve face will be dry, and it will not be lubricated until the engine has made a few turns, consequently a greater force will be required to move the valve when the engine is commencing to move, than after it has been in motion for some time.

2d. Besides the force necessary to overcome the friction, an additional force will be required to overcome the adhesion caused by the oil that remained between the valve and its seat when the engine was stopped.

3d. In starting an engine the valve may occupy a position as shown Fig. 84, that is, the valve covering both steam ports. When this happens the friction between the valve and its seat will not be diminished by any reaction of steam pressure in the exhaust or steam ports; therefore the friction between the valve and its seat will be proportional to the total steam pressure upon the back of the valve. Here, then, we see that, in starting an engine, considerably more power will be required to work the valve than will be necessary to work the same valve after the engine has been in motion for some time. Again, we must not neglect the force required to overcome the friction between the packing in the stuffing-box and the valve-stem, which at times may be considerable, caused by careessly tightening the stuffing-box gland. Thus we can understand what forces a rocker has to overcome; and it must be made strong enough to do it. But to calculate the exact amount of force necessary to move a slide-valve under the foregoing conditions would be impossible; we can only adopt an empirical rule, the correctness of which is based upon close observation in actual practice. The writer believes that, by making a rocker strong enough to overcome $\frac{1}{3}$ of the total steam pressure on the back of the valve, good results will be obtained. Thus, for instance: Example 26; the length of the slide valve is nine inches, its breadth 16 inches, and the steam pressure in the steam chest is 120 pounds per square inch; what will be the greatest force that the rocker must be capable of overcoming? The total steam pressure upon the back of the valve is obtained by multiplying the area of the valve face by the steam pressure per square inch; hence we have $9'' \times 16'' \times 120 = 17{,}280$ pounds, which is the total pressure upon the back of the valve, and $\frac{1}{3}$ of this pressure will be the force that the rocker must be capable of overcoming without twisting or spring the shaft; therefore

$$\frac{17280}{3} = 5{,}760 \text{ pounds}$$

will be the greatest stress to which the rocker can be subjected, or, in other words, the greatest force that it must overcome. Now, when we know this force we can easily determine the suitable diameter of the rocker shaft by calculation.

We find in books relating to the strength of material that, when a shaft is firmly fixed at one end, and a lever attached to its other end, with a force applied to the end of the lever, then the diameter of the shaft sufficiently large to prevent twisting, is determined by multiplying the length of the lever in inches, by the force in pounds applied to the end of the lever, then dividing this product by a constant figure which has been previously obtained by actual experiment, and extracting the cube root of the quotient; this will give the diameter of the shaft in inches.

This rule is used for determining the diameter of a rocker-shaft, and when we apply it we must assume the upper rocker-shaft arm u, Figs. 83 and 84, to be the lever attached to the shaft, and its length equal to the distance between the center of shaft and the center of pin; the constant figure (before alluded to) will be 1200. Hence, to find the diameter of a rocker-shaft made of wrought iron, we have the following:

Rule 10.—Multiply the length of the upper rocker-arm in inches by $\frac{1}{3}$ of the total steam pressure upon the back of the valve; divide this product by 1200, and the cube root of the quotient will be the diameter of the shaft in inches; or, putting this rule in the shape of a formula, we have

$$\left.\begin{matrix}\text{Diameter}\\ \text{of shaft}\end{matrix}\right\} = \sqrt[3]{\frac{\text{Length of rocker-arm in inches} \times \frac{1}{3}\text{ steam pressure on back of valve.}}{1200}}$$

If the rocker-shaft is to be made of cast iron, then the same rule is applicable, with this exception, namely, instead of using the constant figure 1,200, we must use the constant figure 1,000.

Example 27.—Find the diameter of a wrought-iron rocker-shaft, which has to move a slide-valve 9 inches long and 16 inches wide; the steam pressure in the steam-chest is 120 pounds per square inch, and the length of the upper rocker-arm 10 inches.

We have seen in Example 26 that $\frac{1}{3}$ of the total steam pressure on the back of the valve 9 inches long and 16 inches wide is 5,760 lbs. This 5,760 lbs. is the force applied to end of the upper rocker arm; therefore, according to Rule 10, we have

$$\frac{10'' \times 5760 \text{ pounds}}{1200} = 48,$$

and the cube root of 48 is 3.63, consequently the shaft must be $3\frac{5}{8}$ (nearly) inches in diameter. To find the cube root in an easy manner, of any figure, we have simply to look in a table of cube roots, which will be found in any good engineers' pocketbook.

The length of the upper rocker-arm u, Figs. 83 and 84, is limited in either direction; that is, it must not be made too long or too short. For a slide-valve having 5 inches travel, the length of the upper arm is generally made 10 inches, and for valves with less travel, the length of the upper arm can be, and should be, somewhat reduced. Thus, for instance, if the length of the upper rocker-arm for a valve having 5 inches travel is made much longer than 10 inches, then the shaft will be subjected to a greater twisting stress, and, consequently, the diameter of the shaft must be increased, which is not always desirable. The reason why the diameter of the shaft should be made larger when the upper rocker-arm is made longer can easily be seen by examining Rule 10.

Again, the arm should not be made much shorter than 10 inches for a valve with 5 inches travel, for the following reason: It is the custom among the majority of locomotive builders and master mechanics to key the valve-rod to the valve-stem, as shown in Fig. 84, thus making a rigid connection. Now, notice, in Fig. 84, that the path of the valve-rod pin is an arc, as $x\ y$, and to this arc the end of the valve-rod must accommodate itself; and since the valve-stem must travel in a straight line, and since there is not a flexible joint between the valve-rod and stem, it follows that the valve-rod must be sprung out of a straight line during the travel of the valve, and the amount that the latter is sprung out of a straight line is equal to the line $a\ b$, Fig. 84. Now, if the upper rocker-arm is made much shorter than 10 inches, but leaving the travel of the valve the same as before, then the line $a\ b$, will be longer, and, consequently, the amount that the valve-rod must be sprung out of a straight line during the travel of the valve will also be greater than before, and thus produce injurious results.

The width of the rocker-arms on the line $c\ d$, passing through the center of the shaft, as shown in Fig. 84, is not made the same by the different locomotive builders or master mechanics, yet the following arbitrary rule will give a width agreeing very closely with the present practice.

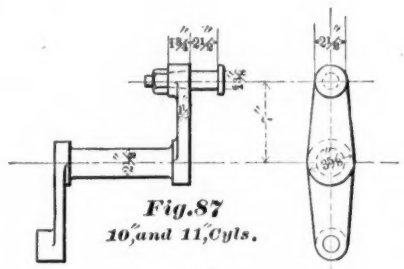
Rule 11.—To the diameter of the rocker-shaft add one-half of the same diameter, and from this sum subtract $\frac{1}{8}$ of an inch. Or, in the shape of a formula we have:

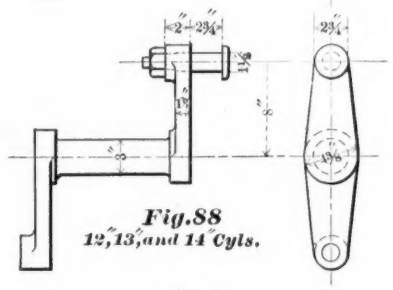
Diameter of shaft + $\frac{1}{2}$ of diameter of shaft — $\frac{1}{8}$ of an inch = width of rocker arm at $c\ d$.

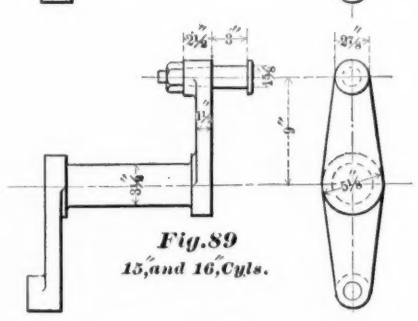
Example 28.—Diameter of the rocker-shaft is $3\frac{5}{8}$ inches, what must be the width of the rocker arm at $c\ d$?

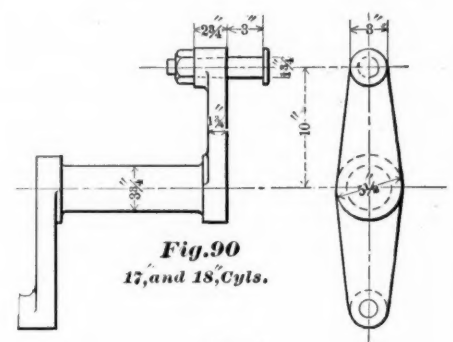
$$3\tfrac{5}{8}'' + 1\tfrac{13}{16}'' - \tfrac{1}{8}'' = 5\tfrac{5}{16}'', \text{ say } 5\tfrac{3}{8}''.$$

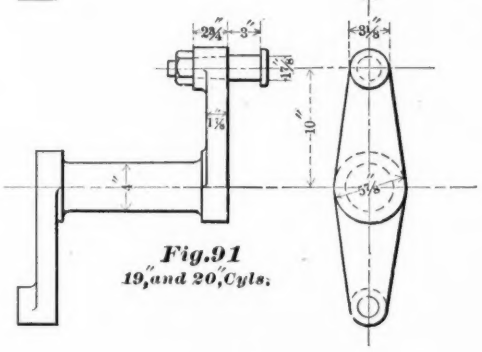
When the width of the rocker-arm at $c\ d$ is known its thickness can be easily ascertained in the following manner: Assume that the arm is a lever firmly fixed at one end and loaded at the other end, as shown in Fig. 85. Then according to rules found in books relating to the strength of material, we find that when a beam or lever is firmly fixed at one end and loaded at the other, the weight which it can support with safety is determined by multiplying the square of the thickness by the width, and by a constant figure, previously found by experiment (this figure is generally called the "coefficient"), and dividing this product by the length of the beam or lever. In

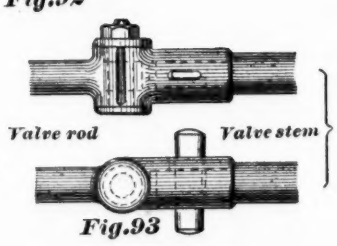


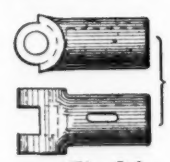


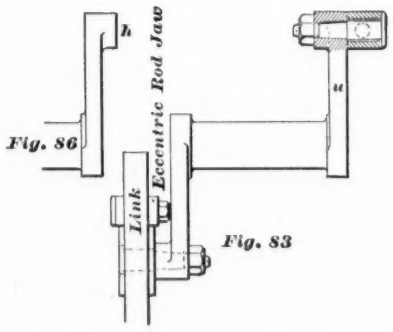


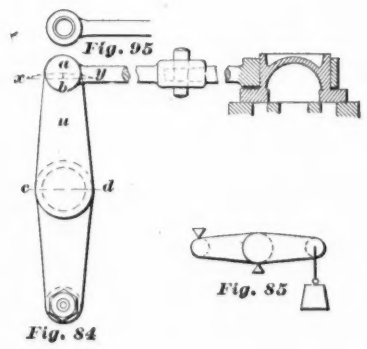












applying this rule to the rocker we shall adopt 1,200 for the constant figure or coefficient, and the dimensions of the rocker will be taken in inches; therefore we have

$$\frac{\text{Square of the width } c\,d \times \text{thickness} \times 1200}{\text{Length in inches.}} = \text{load}$$

Now, if we know the load, the width at $c\,d$ and the length of the rocker-arm, but not its thickness, we can establish a rule from the foregoing formula which will enable us to find the thickness of the rocker-arm.

Rule 12.—Multiply the load in pounds by the length of the rocker-arm in inches, and divide this product by the square of the width multiplied by 1,200; the quotient will be the thickness of the arm. Or in the shape of a formula we have

$$\frac{\text{Load} \times \text{length in inches}}{\text{Square of the width } c\,d \times 1200} = \text{thickness in inches.}$$

Example 29.—What must be the thickness of the upper rocker-arm, its width $c\,d$ being $5\frac{1}{2}$ inches, and the valve which the rocker is to move is $9'' \times 16''$; the steam pressure in the steam chest is 120 pounds?

The total load which a rocker has to support is equal to the greatest stress to which it can be subjected, and as we have seen before the latter is equal to $\frac{1}{3}$ of the total steam pressure upon the back of the valve.

Now, according to Example 26 we know that $\frac{1}{3}$ of the total steam pressure upon the back of the valve $9'' \times 16''$ and with a pressure of 120 pounds per square inch is equal to 5,720 pounds, which must now be considered as the load, consequently we have, according to rule 12:

$$\text{Thickness} = \frac{5720 \times 10''}{(\text{square of } 5\frac{1}{2}) \times 1200} = 1.58 \text{ or } 1\tfrac{9}{16}''$$

nearly, which is the thickness of the rocker-arm.

In a great many locomotives we find the hub h on the upper rocker-arm placed upon the outside of the latter as shown in Fig. 86. This should be avoided as much as possible, because when the hub is so placed, the arm will not only have to resist a transverse stress, but also a twisting stress, and therefore the arm and shaft must be made correspondingly strong. If the hub is placed upon the inside of the rocker arm as shown in Fig. 83, then the twisting stress will be reduced, but yet not altogether removed. To allow for this extra twisting stress which still remains, we have adopted in the foregoing rules a coefficient of 1,200. If the rocker-arm had no twisting stress to resist, but simply a transverse stress, then the coefficient of 1,200 could have been increased to 1,800; the result of this would be a thinner rocker-arm.

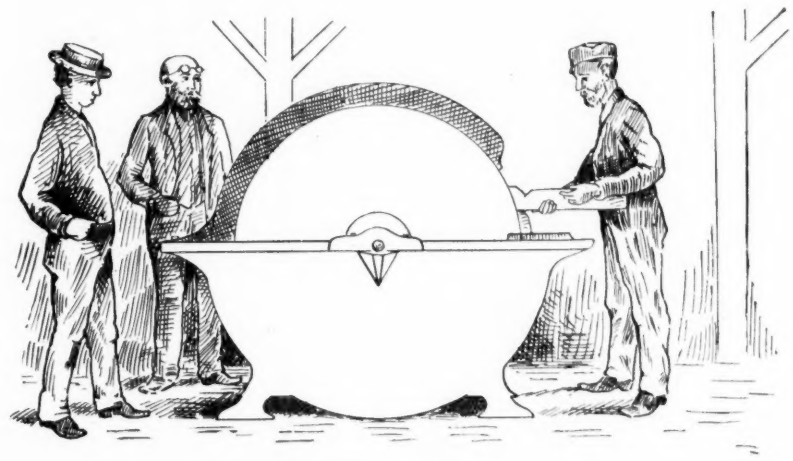
On the lower rocker-arm we are generally compelled to place the hub on the outside of the arm, because room is required to clear the eccentric-rod, jaw and pin, as shown in Fig. 83. Figs. 87, 88, 89, 90 and 91 show the rockers for the different sizes of locomotives. The diameters of the shafts and dimensions of rocker-arms have been obtained according to the foregoing rules, and are suitable for cylinders whose ports are proportioned for a piston speed of 600 feet per minute, the valves having the ordinary amount of lap, and the steam pressure 120 pounds per square inch in the steam chest. Comparing the dimensions given in these illustrations with the dimensions of rockers in actual use in modern locomotives, it will be seen that the former agree very closely with the latter. Of course, the length of arms given in the illustrations may have to be changed to suit some particular design of engine, and, when the change is very great, then the dimensions of arms and shaft should be determined according to the foregoing rules.

Again, to be very exact, we should have given a different-proportioned rocker for each size of cylinders, but this would cause a complication of patterns, which managers of private establishments and master mechanics on railroads seek to avoid; hence one size of rocker is generally used for two or three different sizes of cylinders—that is, cylinders varying in diameter.

Now, as simple as a rocker may appear to an ordinary observer, it requires care to proportion it. If the rocker is made too weak, it may still be strong enough to move the valve, yet it will spring sufficiently to derange the whole valve motion. Indeed, we have met with locomotives which, on leaving the round-house, had such an irregular exhaust that the engineers stopped the engines and examined the valve motions, but found that the cause of all the trouble was the springing of the rocker-shaft—a trouble which would disappear after the valve-face and seat became lubricated by running the engines a short distance.

When the valve-rod is comparatively very short, a knuckle joint must be introduced between valve-rod and stem, as illustrated in Figs. 92, 93 and 94, and which needs no further explanation.

In a few cases the valve-rod end, which connects to the rocker-pin, is provided with brasses and a key, so as to take up the wear. But the almost universal practice in the construction of American locomotives is to drive a bush into the eye of the valve-rod, as shown in Fig. 95. This bush is made of wrought iron, generally three-sixteenths of an inch thick for large locomotives and one-eighth of an inch for smaller engines. The bush is bored and turned and then case-hardened, and finally forced into the eye of the valve-rod by an hydraulic press. Valve-rods, with case-hardened bushes, will need but very little repair, as the wear is comparatively slow, and, when the wear of the bush becomes too great, it can be easily removed and replaced by a new one with very little expense.



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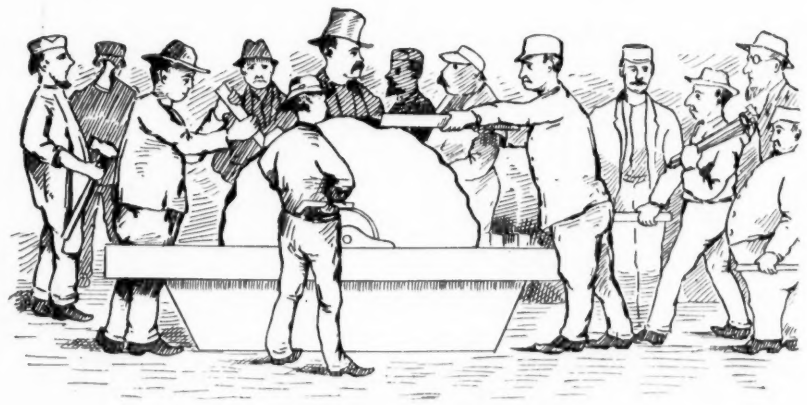


THE PUBLIC GRINDSTONE.

Jamb-nuts That do Not Jamb.

BY JAMES F. HOBART.

It is a common practice around the shop, when a bolt is required to hold without fail, to screw the nut down as tight as possible, and then put on another nut, screw that down with all the power available, call it a "jamb-nut," and expect it to surely hold.

Let's investigate a bit and see how the contrivance acts in actual practice. We will take for example, the bearing of a tumbling barrel, consider it as bolted to a cast-iron frame, and the bolts secured by "jamb-nuts." We are bound to have the box stay in place, so we pull with a force of 200 pounds on a 12" monkey wrench, until the nut is "home."

Now, that bolt is pulling the box and frame together with a force of about 45 tons. If the nut were loose, it would only touch the bolt threads on their undersides, which, in time, would bear upon the upper sides of the nut threads.

When we screw down another nut, this condition is not altered in the least. We have only doubled the thickness of the nut, without in any way locking the two nuts together. If we put two nuts upon a bolt, or a stud, and with two wrenches we turn the nuts in opposite directions until they come together and we can turn them no farther, then we have a "jamb-nut" that is a lock, and the stud may be turned in or out of its seat, or even twisted asunder without starting the nuts.

Let us now apply the same method of tightening to the two nuts on our tumbler barrel box. We will screw down the nuts precisely as we did before, then, holding the upper nut with a wrench, turn the first nut *backward* with a second wrench, until all the "lost motion" between the bolt and nut has been taken up. Now, instead of the strain coming alike on the upper side of each nut thread, the first nut takes its bearing on the under side of its threads, exactly as did the lower nut on the stud.

The load is all borne by the upper nut, the first nut being the "jamb-nut," not the upper one, as many are apt to suppose. When two nuts are applied by the first method, to a bolt in some yielding material like wood, the upper nut may be screwed after it reaches its bearing upon the first nut, the "slack" or "lost motion" thus taken up, and a true lock may be so formed.

Turning the first nut backward, after the second nut is screwed home, does not loosen the bolt at all. The load is held entirely by the upper nut; but the tendency is to pull the bolt apart at the point between the two nuts. Owing to this fact, a greater factor of safety must be allowed for bolts having genuine "jamb-nuts," for if the friction on our first box-bolt nut be not taken into account, it would be possible to put a strain of 90 tons upon the bolt at a point between the two nuts.

The Mechanics' Institute, of San Francisco, Cal., opened a night school January 18, to continue until the last week in May.

The branches covered are mechanical drawing, free-hand and perspective drawing, geometry and trigonometry, and the Spanish language. Competent teachers are provided for all branches.

LETTERS FROM PRACTICAL MEN.

Two Grindstones.

Editor American Machinist:

I enclose you a card on which I have made a rough sketch of two grindstones: one the public grindstone, and the other "for machinists only." The latter is true and furnished with a tool-rest, and partly covered with a sheet-iron splash-guard, so that all tools have to be ground on the front of the stone, on the rest. The former stone is in execrable order, as is generally the case in many shops. A man is attempting to grind a tool by letting it bump up and down on top of the stone. Blacksmiths' helpers are waiting for their turn with sledges, flatters, chisels, etc.; another man is making an abortive attempt to grind a round-nosed tool on the top of the stone. Some very good articles appeared in the AMERICAN MACHINIST last year from the pen of Frank H. Richards, on "Grinding Tools."

A first-class workman in a shop where high-class work is done, is just as particular in the grinding of his tools, as in his work. He takes just as much pride in having his roughing-out tools cut clean and free, as to have his finishing tools do so. A man that tries to take short cuts by dubbing the edge of his tools every time he grinds, is a butcher. I am aware that some men think otherwise and maintain that the quickest way is to "jamb" wrought-iron off dry, and then make a vigorous attack on the rod or shaft with a file. Nothing leaves better work than properly ground, clean-cutting tools. To make a fine edge, particularly on flat tools, a flat, true stone is indispensable.

C.

[We do not usually publish caricatures, but our correspondent's pictures tell their story so graphically that we make a departure from usual custom in this instance.]

Crown Face Pulleys.

Editor American Machinist:

The almost universal practice of turning pulleys with a crown face involves considerable loss of power. The usual height of the crown in most pulleys is about $\frac{1}{8}''$ in pulleys of 12" face. This means that the pulley is $\frac{3}{4}''$ larger in circumference at the middle than at the edges, consequently the belt must slip that amount every revolution. In the case of a dynamo running 1,000 revolutions per minute, and its driving pulley having a simi-crown, running say, 200 revolutions per minute, the amount of slip in both pulleys is 900" per minute under a tension sufficient to transmit, say 30 horse-power, representing a loss of about $\frac{2}{3}$ of a horse-power.

C. W. CRAWFORD.

Brazil, Ind.

"Rules for Engineers and Firemen."

Editor American Machinist:

J. E. M., in your issue of Jan. 23, says he would like to hear from others, who have had experience with dirty water in boilers. It is a well expressed opinion that a large part of the failures of boilers is caused by improper blowing down. Having had considerable experience with muddy water in boilers it seems to me it is only a question of time, and with some a very short time at that, until a set of boilers are ruined by bad management.

The mud valve is practically of no value for blowing mud from a set of boilers under steam pressure. It is not practical to suppose that so small an opening as a mud valve will create a current sufficient to draw the mud from a boiler. It will not even take the mud that has settled in the drum.

I used to be a strong advocate of the mud valve to relieve the boilers of mud, but experience has taught me that it is not only a waste of water, but of fuel as well, to heat the water that takes the place of water uselessly blown away. It is true when the mud valve is first opened the discharge is very muddy, but it is only the little that settles very near the opening of the valve that will be got rid of in this way.

If J. E. M. will crawl into a boiler after it has been cooking muddy water for three or

four weeks, before it has been washed, he will find mud by the peck sticking around the water line, especially in and near the corner where the water gauges are. It makes no difference how much you use the mud valve; you will find this to be the case. Only the mud will be harder to remove an account of blowing the water away from it so often, causing it to cook fast in the first process of scale forming.

I would suggest that a pipe be tapped into the opposite end of the boiler from the fire, say not less than 1¼″, in diameter—the larger the better—just low enough so that the mouth of the pipe will be covered with water. Then blow as often as you please, the oftener the better, but the blow should not be kept open longer than a half minute at a time. I would also suggest for very muddy water that you blow as you fire. S. A. S.

Blowing Down Boilers.

Editor American Machinist:

In your issue of January 30th, J. E. M. questions the adaptability of blowing down boilers according to rule given. I heartily agree with him in that respect as regards this country. It is the most injurious thing that can be done to a boiler using this water, especially the class of boilers used for threshing, which are often blown out at 90 pounds pressure on Saturday night, doors thrown open and left to the cooling (and contracting) influence of the atmosphere and a Dakota blizzard.

By practical experience with this kind of boiler, particularly the locomotive form of boiler with water bottom fire-box, I find by blowing off only after the boiler has been standing still long enough for the circulation to become comparatively subdued, that the sediment goes to this water bottom and a large portion is then thrown out through the blow off.

In a boiler of the above description blown down in that way every day for two weeks, then allowed to cool entirely, water run out and hand-holes opened, I find 2″ of soft slush in the water bottom, and not enough in shell of boiler to fill a quart cup. In the same class of boiler, differently handled, I have seen water bottom, leg, and shell, so filled up in six weeks as to require new flues and stay bolts. In one instance the crown sheet came down inside of two weeks.

Dakota. SCRUB.

Suggested Addition to Angle-Plate.

Editor American Machinist:

In No. 5, current volume, a convenient angle-plate is illustrated and described by A. B. Landis. About thirteen years ago I came across an angle-plate very much like this one, with the exception that it was not graduated on the arc as the one illustrated. I think the graduation a decided improvement. But an advantage in the one I saw, and which might easily be added to Mr. Landis' device, consists in a round top on which the work is bolted. This top was a separate plate, turning on its center and graduated on its edge. The plate was used under a large drill. A half-globe, fastened on this, could be reached with a drill at any point, or, in other words, it was available 90 degrees from the center in any direction. WM. SCHNEIDER.

Cleveland, O.

The "Grip."

Editor American Machinist:

Everything pertaining to cable roads and cable machinery has been so fully and clearly delineated and discussed in the AMERICAN MACHINIST and some other papers, within a few years, that the people, who have felt an interest in the matter, are doubtless quite familiar with the progress and mechanical features of the cable system. Some pertinent matter recently appeared upon the subject in the AMERICAN MACHINIST of December 26, 1885, touching the bridge cable, and in the issue of January 30, 1886, pertaining to the cable lines in San Francisco.

This matter is suggestive of the following questions? 1st. How does it happen that the "grip" is so troublesome in the first instance on grades of less than 190 feet per mile, while in the latter case the "grip" works all right on grades of 960 feet per mile? 2d. Does it require any more power to move 50 tons up a 190-foot grade than it does to move 10 tons up a 950 foot grade? 3d. In view of the fact that it requires several times as much power to start a car as it does to keep the car in motion after it is started, why should not the track be so graded at the starting points that gravity may assist in starting the cars? 4th. In view of the fact that the average angle of friction is about half of one per cent., would not a one per cent. down grade at the starting places afford a great relief to cable and "grip"?

Another question is suggested by the San Francisco article, which says: "Cars are obliged to stop while ascending these heavy grades to accommodate pasgengers." Now, in view of the fact that the starting a car-load of passengers up such heavy grades imposes great strain on cable and "grip," is it a wise procedure on the part of the management of these lines to allow their cars to stop while ascending grades, when a few rods in either direction would give them a level track upon which they could stop and accommodate travel? F. G. WOODWARD.

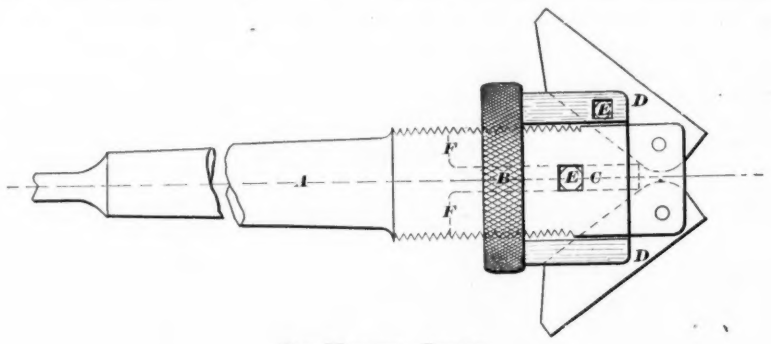
Fly Milling Cutter.

Editor American Machinist:

Enclosed is a sketch of a fly milling cutter for beveling odd jobs which sometimes find their way to the milling machine. It will be seen, by referring to the sketch, that it is adjustable to quite a range of angles and is very rigid.

To adjust, loosen the three set-screws *E E E*, and move the sliding collar *C* (which slides over the thread) by the milled nut *B*. Two slots are cut in shank to receive cutters as shown by dotted lines F. The set screws *E E* should be slightly inclined so as to bed the cutters firmly on collar *C*. The center set-screw holds the collar *C* in place, and should bed itself in a shallow key-way cut on the threaded shank. This cutter can also be used for countersinking and re-seating. I have seen nothing like this before.

LEE C. SHARPE.



FLY MILLING CUTTER.

A Universal Bevel.

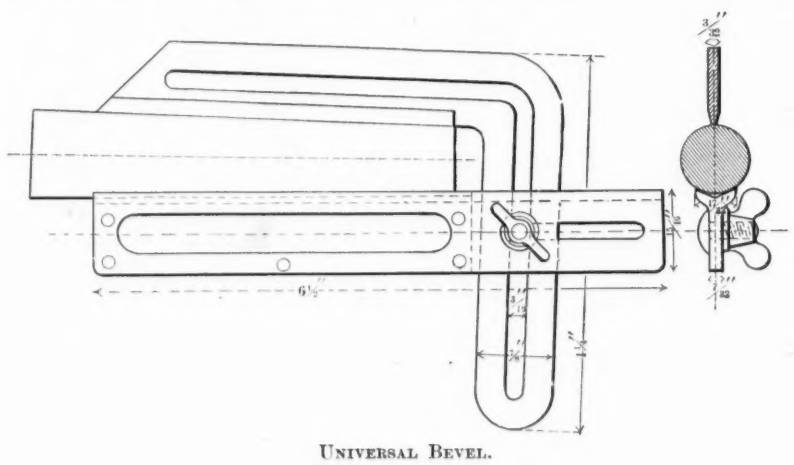
Editor American Machinist:

The bevel shown in the engraving is one I designed some time ago for my own use. Its chief points consist of a knife-edge blade in connection with an angular groove in the beam, as will be seen in the end view. The object of the angular groove is to center any cylindrical piece which may be placed in it, as is shown in the engraving in which a taper piece is represented with the knife-edge blade closed upon it. This form of bevel will be found useful in turning taper pieces, such as lathe centers, arbors for drilling and milling machines, taper taps and reamers, former pins for profile or edging machines, and a variety of other articles. It will be found particularly useful in turning taper pieces when it is not convenient to have and use the spindle for the purpose of fitting during the process of turning, when the cut and try system is usually resorted to.

When a new piece is to be turned, to replace an old one, bring the small end of the taper which has been previously fitted to the end of the beveled knife edge, as shown in the drawing. It is generally the case that this small end of taper is turned down below size some distance from the end, or the corners rounded over to prevent enlarging or upsetting by being driven out of the spindle. Now by placing the extreme end of the old center on arbor in line with the end of the beveled knife edge of the blade, and turning the piece until it comes to this end, it will be found that if the taper is right, which will be shown when placed in the bevel, that it will fit the first time.

When well made and carefully adjusted this bevel forms a perfect taper gauge, the same as a solid one. The length of the knife edge should be at least 4 inches, and the tongue of blade as shown in the beam 3½ inches from the knife edge. This length will admit a taper 2½ inches at the smallest end. The lower part of the beam is left solid to admit of fitting templates of any angle. When fitting such templtae reverse the knife-edge blade in the beam so as to bring it in contact with the template. This tool will be found useful for a variety of other purposes that will present themselves from time to time.

Somerville, Mass. C. E. SIMONDS.



UNIVERSAL BEVEL.

Professor Hermann's apparatus for determining the values of various lubricants for machinery consists of a perfectly cylindrical shaft supported on two journals carried by a branched support, which so turns on a hinge that the shafts can be adjusted at an angle of five to ten degrees to the horizon. The upper end of the shaft is rotated by means of a handle. To use the apparatus, a bent piece of the same metal as that to which the lubricant is to be applied is placed astride of the shaft and suitably weighted, and the number of turns of the handle requisite to cause it to slide along the shaft with various lubricants are noted. The greater the distance traveled for a given number of revolutions, the more efficient the lubricant.—*Mechanical World.*

The Bureaus of Labor Statistics, of such States as have them, are bringing into prominence two facts well known perhaps in a general way before. One of these is that children are very generally employed in factories in defiance of all law regulating the matter; the other the beggarly price which, in the majority of instances, is paid women for their work in large cities. These things can only be remedied by the creation of a healthy public spirit against them, hence the more publicity given them the better.

Engineering tells of a double-barreled gun of a somewhat novel description for a steam yacht. The gun is mounted on a pivot, and the total length is 53 inches, the weight being 115 lbs. One barrel is rifled and the other is smooth bore. It will fire a 10 oz. explosive bullet of steel, or a 13 oz. solid shot. There is also a harpoon to be fired from the smooth-bored barrel. The gun can also be used for wild fowling, and for this purpose is loaded with 18 drams of powder and 7 oz. of shot.

The duplication of the parts of machines—manufacturing under the gauge system—has resulted in a remarkable reduction in the cost of many standard machines, and at the same time has, in a less ratio perhaps, improved the quality. It follows, if it is determined experimentally, that a "running" fit should be a certain decimal of an inch loose, that the duplicate system will provide for the exact degree of looseness much more accurately than can be done through the judgment of the very best workman. Besides this the system of duplication calls for the best processes of doing the work; not alone the quickest processes, but generally the best otherwise. The gauge system, as in use in this country, is one of the most valuable elements of cheap and reliable machine construction; there is ample room for its development.

Liquid Fuel for Steamers.

Another application of liquid fuel to steamers has been made on a new ship recently launched by Messrs. Wigham, Richardson & Co., of Newcastle-on-Tyne. The steamer, which is intended for the Black Sea trade, and which is to be permanently oil-burning, has her water-ballast tanks divided up and made available for the storage of her fuel. There are also other storage tanks built into the ship on each side of the engine room, all these being connected by pipes to the small feed tanks placed above the boiler. A large supply pipe, connected through valves to the storage tanks, allows of the vessel being filled up with fuel in a very short space of time. The oil-burning apparatus has been fitted by Tarbutt's Liquid Fuel Company, of No. 75 Lombard street, London, and is similar to that adopted on board the steamer Himalaya, which recently made her successful trial trip from London to Granton and back with the new fuel, as described by us at the time. It consists of an automatic starting arrangement, which provides for the supply of oil to the furnaces during the period of getting up steam without the aid of an auxiliary boiler, and an arrangement for highly superheating the steam which is used for forcing in the oil, and by its means raising the temperature of the fuel to the burning point, as it enters the furnace. A trial of the apparatus has just been completed at Messrs. Wigham, Richardson & Co.'s works, and was witnessed by representatives of some of the leading shipbuilding and engineering firms on the Tyne, who are evincing great interest in this most recent development of the fuel question. The first trials made showed that the evaporative effect of the oil used, which was a residue of Scotch shale oil, was 15½ lbs. of water to each pound of oil, as against from 8 to 9 lbs. for 1 lb. of coal. Subsequently the engines, which are only just completed, were started for the first time, and were kept running for some hours at from 84 to 96 revolutions per minute. The trials were altogether a great success, and it is understood that a number of other applications of this system of burning liquid fuel are now being made, both to marine and stationary boilers, as well as to stills and plate-heating furnaces.—*Iron.*

According to the annual report of the American Society of Civil Engineers, the total membership is 928.

Adjustable Tap and Reamer Wrench.

The jaws of this wrench are made of tool steel, hardened and tempered. The screw which moves the movable jaw is protected from dirt, which would otherwise clog and wear it. The wrenches are well finished and are strong.

Wells Bros., Greenfield, Mass., are the manufacturers.

Starrett's Lock-joint Calipers.

These calipers are provided with a device for locking the joint, making them rigid when adjusted to proper size. From the joint a slot extends to the end of the long arm; this can be opened or closed by a cam controlled by a thumb-nut. Turning this nut in one direction loosens the joint, so that the calipers can be quickly adjusted to the required size, then by a turn in the opposite direction the joint is rigidly tightened.

For fine adjustment there is a slot in the short arm; by turning the thumb-screw the short arm is sprung slightly in or out, giving the closest desired adjustment.

The manufacturer is L. S. Starrett, Athol, Mass.

Blast-furnace Engineering.

By W. B. Hess.

Water Works—Repairing a Blowing Cylinder — Mending a Packing Ring — A Wooden Packing Ring.

To repeat the remark of a well-known and successful iron founder and furnace superintendent, "Too much importance cannot well be attached to the water works of blast-furnaces." This applies especially to the capacity of pumps and the kind of pump used for supplying the tank water, and the kind of water used, as well as the tank elevation. Much valuable time and a great amount of trouble, to say nothing of the cost, would be saved to furnace proprietors, if, when putting up tanks and putting in new machinery of this class, they would give it just the right amount of thought, and adapt it to meet their wants. The tank should, in many cases known to the writer, be placed higher, giving a sufficiently strong pressure, when desired to stir up the sediment, which is always likely to accumulate in tuyeres. The additional cost of raising the water a few feet higher is comparatively small, as compared with losses occurring from inadequate water supply—rather pressure, for pressure is actually necessary in using some water, on account of its character. Taking water from ponds, or basins used to catch water, to use over again, is also productive of much injury to tuyeres, as well as boilers. The writer is acquainted with one case in which parties changed from iron to phosphor-bronze tuyeres. They lost them at a rate that is almost incredible, as they had used iron tuyeres all along, with what they thought fair success. They were advised to change from pond water, which they did, and now they have no trouble with tuyeres.

Another source of much trouble that could be remedied at small cost is in the water-supply pipe, and the manner in which the connection-pipes are attached. A 3″ pipe around the furnace, to supply six tuyeres, may do it very well for a time, but generally much trouble will be saved by using 4″ pipe; in other words, keep on the safe side by figuring on about fifty per cent. loss of carrying capacity.

Not long since, one of our blowing engines broke a packing ring. It had worn thin on two opposite sides. A new one was ordered, but before it came, the old one gave out—broke in four pieces. We repaired it by constructing a sort of platform of boards, nailed to 4″x4″ scantling and planed off smooth, so as to strike circles of diameter of ring. Rivet holes were drilled in the pieces of ring, which was 4″ wide by $\frac{7}{8}$″ thick, of brass. We then took iron, $\frac{1}{4}$″x4″, bent to form an inside circle, and also drilled for rivets to correspond with the pieces of packing ring. The iron was riveted fast to the brass at thick places in the ring, and the two rings thus formed were set to correspond with the circles described on the platform. The space between the rings was run full of babbitt metal, then the rivets of copper hammered. It was put in, and after running some time the new ring came, but the one repaired is still doing service, and promises to last as long as a new ring.

We had occasion to bore out one of our blowing cylinders, it having got cut, which we did in place; cylinder 72″x58″, two cuts in 130 hours. In order to avoid getting a new piston head, we concluded to try a wooden packing ring, which we had made of well-seasoned maple wood, in short sections. The ring was in ten pieces, the joints carefully fitted, lapping over on the ends 3″, then doweled together and a $\frac{3}{8}$″ hole bored in the joint where the ends of the sections join, and pieces of rubber inserted, so as to make an air-tight joint. Then holes were bored into the ring from the side, and coiled brass springs compressed into them, which act to set the ring out. The springs were put in about every 6″. This has been in use about two years, giving good satisfaction. Occasionally the cylinder is opened, and a little tallow and plumbago rubbed on.

Tap and Reamer Wrench.

Working Steel and Iron.

By S. W. Goodyear.

One of the most extensive consumers of iron and steel for structural purposes in this country had occasion to use a large number of iron plates, of exceptionally large size and of unusual thickness, which must possess a degree of tensile strength and undergo tests for bending qualities which, coupled with the thoroughly dense and uniformly sound condition required, made their procurement, for a time, seem, if not impossible, at least quite doubtful. Many unsuccessful attempts were made by the party to whom the work had been entrusted. Much correspondence, with many suggestions, had resulted, and still no plates to answer the requirements. Something must be done, and so the inspector, a man well versed in all the peculiarities of all the different irons with the effect of sulphur, silicon, phosphorus, etc., etc., at his tongue's end, was sent to try to straighten the matter out. Arrived on the ground, he first learned what iron had been used, and next expressed the opinion that there was no hope of success with it. He told them just what iron to use, why it would stand the tests, and why the other would not, his explanation being highly scientific and exhaustive. He then submitted to a close examination by the superintendent of the mill, a very clear-headed, practical man, who had risen from the position of puddler, and who proceeded to draw from the inspector a minute description of the uses to which the plates would be put, as well as the ordeals of test through which samples must pass. The next plates proved entirely successful, and the entire order was filled without the rejection of a plate. So the scientific knowledge of the inspector hit the nail on the head the first time. Not too fast. The superintendent, with the new insight gained of the requirements, saw where his methods had been wrong, and with no change of material whatever, simply varying the plan of working by the rolls, and then improvising a chamber where the cooling off should assume the character of an equable annealing, the same iron which had been condemned, in every instance proved a success.

Lock-Joint Calipers.

There is a belief prevalent in the minds of mechanics that cold-hammering, much cold-working, will harden metals very materially, in fact, that steel will be hardened in that way to an extent that precludes the possibility of drilling it. I remember a case in point. Used as packing in a machine for nearly a year, where for ten hours per day, minus ordinary stoppages, it had been subjected to not less than one thousand blows or compressions of many tons' weight per minute—say a half-million of such compressions daily—was a piece of cast-steel of about three square inches' area, and something less than $\frac{1}{4}$″ in thickness. Becoming too thin, this piece was replaced by a new one. Some time after, my tool-maker asked me for something to drill and tap, to be used as a gauge to cut some screws to, and I gave him this piece. Much to his surprise, the hole was drilled and tapped as easily as would have been the case with any well-annealed piece.

I once had occasion to cold-swage some round steel wire into a shape which would be presented by a twist drill with the twist taken out. Here was a great amount of metal to be displaced in forming the grooves, while, if feasible to do it in that way, the rest of the metal needed little disturbing. I swaged pieces which came out of the dies entirely sound, *except* they were split in two just as far as the full depth of groove extended. I swaged other pieces, in which the center—the part representing the bottom of the grooves—was perfectly sound, and the edge—the periphery—was full of transverse cracks. I swaged pieces which were just as sound as the wire had been before swaging. How? In the same dies, with the same wire, but under modification of the one, and different treatment through that modification of the other. What was the secret of success? Simply working all parts of the piece at once, and holding all parts up to the work.

To those who say hammering steel causes it to flow on the outside, and tears it from the center, the inspection of bars of different sizes, in which fracture will reveal entire soundness and uniform structure throughout, should suggest that there is hammering, and hammering. Not that hammering is done, but how it is done. As between using a certain weight of tilt-hammer, and one much lighter, for drawing to shape and size steel articles which were to be hardened, I was once told by a manufacturer there was so great a difference as to rarely lose a piece from hardening cracks from one hammer, while from the other so many pieces cracked as to make the manufacture a commercial failure. In this case the cracked pieces were from the heaviest hammer. The blows had been too heavy, but there is no doubt that to have been too light would have proven just as disastrous.

There is, perhaps, no better way of getting at facts in relation to this question of loosening up the center of a bar than to draw comparisons between different methods of hammering. How it is done, is the question. The two extremes are to be found first in swaging between dies which, from size and shape, as compared with what they are working upon, hold the work from lateral expansion, as far as possible, in all directions, at the same time covering and bringing under pressure a considerable portion of the length, the object being reduction, and consequent elongation, always making each blow or compression reduce without distortion, and forcing elongation to take place against a resistant force. This insures immunity from the loosening-up effect, and just in proportion as the resistance offered to the natural tendency to escape from pressure in the easiest way is thorough, will the condensation and closing up all porosities and the equalization of molecular condition be thorough.

The other extreme would be found in attempting to reduce and elongate round bars by hammering or compressing between plain faces as between hammer and anvil, or by the process called rotary rolling, *i. e.*, between rolls whose axes are practically parallel with the axis of the piece or bar being acted upon. In these ways there is no resistance to distortion at every blow or compression, except through the rigidity of the metal itself. The pressure in any given direction inclines the metal to escape, and with nothing to prevent, the entire operation is one of constantly shifting distortion, which only needs to be continued to tear the center of the bar in pieces. By the rotary rolling process both of two results have been reached. Bars have been literally burst asunder, while others, without being reduced appreciably in size, have, through the attempt, had their surfaces entirely broked up as badly as those of rails which have long stood the traffic of heavy trains, the effect, where actual crushing does not reach through the bar, being identical.

The writer was once told by an experimenter in this direction of rotary rolling, which has seemed so fascinating to many men, that he had discovered that the molecules in iron and steel had their axes longer in one direction than in the other, and that they arranged themselves with their longest axes in the direction in which the working had taken place; thus, in a round bar rolled in grooved rolls, the axes would be parallel with the axis of the bar, and the fact that he had known rotary rolling to increase the size of a bar, had confirmed his belief in the theory.

How much easier it would be for the plain mechanic to conclude that a force which carried on to its legitimate effect in any one direction would inevitably burst the bar asunder would, when applied alternately in all possible directions, have its disintegrating effect on the entire bar, the tendency of which would be to increase the size; that loosening up and disaggregation was a better name for the phenomena than that of changing axial direction on the part of elongated molecules. Is it not a fact that the bulk of iron and steel working comes between the two extremes named, and is better or worse, so far as method goes, just as it is most nearly like the one or the other of the two methods, one of which may safely be called the worst, at least, which can be applied?

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Iron Foundry Progress.

Improvement in no branch of iron-working has been more marked during the past five years than in foundry work. And the necessity of such improvement is, perhaps, more apparent in this branch than in any other. The facility with which iron can be got into desirable shapes in the foundry will probably always keep the proportion of castings to forgings in machinery about as at present, hence the subject of foundry production will always be one of the most important connected with machine manufacture. But it is a subject that until a comparatively recent date has received but little attention. Boring, planing, and turning castings—the various machine-shop practices—have received the attention of the manufacturer and the engineer, to the neglect of proper consideration of the first step; that is, making them in the foundry.

The strength of castings has for years been referred back to ancient time-worn experiments—to the earlier days of the art—more frequently than to modern experiments; in fact, modern experiments have not been numerous enough to afford much opportunity for reference. This lack of live interest in the matter has stood directly in the way of progress. It can only be defended on the assumption that the art of making castings from iron was practically perfect in its infancy. In other matters relating to iron-working, a man who referred so far back for data would be looked upon as mildly insane.

To the uninitiated there is but little difference in iron castings, except as one may be a little smoother than the other. To those better acquainted with the subject, there is known to be an enormous difference in the strength of castings made from different mixtures—a difference eutirely disproportionate to the difference in cost. Different manipulations are also known to have an important bearing, but why these things are so, is seldom inquired into in such a way as to afford information susceptible of general application.

As previously intimated, these things are receiving more attention of late, and much good is likely to result from it. Foundrymen are providing means—frequently crude, but better than no means—for making tests of the iron they use, and the influence of different forms on the strength of castings is more thought of than it formerly was.

In the foundry, among the workmen, the reading habit is becoming more common, and will accomplish a good end. A few years ago those who were willing to study matters relating to the art they practiced, found little printed matter having reference to it. This is now changed, to a great extent; foundry matters receive a good deal, if not their due share of attention from the technical press; this is notably true in European countries. In addition to this, valuable books on foundry practice are appearing. The moulder of the present can find about the same opportunities for getting information by reading that other craftsmen can. And he is benefiting, and will benefit by it, as much as they. These influences will, in the end, do valuable service in changing the quality of iron castings, the ways of making them, and the character of the foundry as a workshop, to the advantage of those who use castings as well as those who make them.

There remains much yet to be done in iron foundry matters; there is wide difference in respect to what is being done in different foundries. In some it can be seen at a glance that managers are fully alive to the necessity of progress, and in such the workmen will be found equally wide awake. In others, old methods are clung to, and it is taken for granted that a foundry must possess some of the dark, inconvenient features of its earlier days; corresponding men will generally be found to fill such foundries. Nothing is surer than the tendency of workmen to get into sympathy with their surroundings. But this will gradually give way to more enlightened ideas, and there will be more of certainty and less of trial in the foundry of the future. And this will, beyond question, have an important influence on the economy of manufacturing in the future.

Distributing Railroad Passes at Albany.

We cannot see the point to the spasm of indignation over the fact that the free passes from railroads were distributed openly this year to the lawmakers at Albany, instead of covertly, as usual. The fact that their distribution was not private was probably a blunder in so far as intention was concerned, but it was not a crime, and sheds absolutely no new light on the subject. It was well known before, that members of the Legislature were supplied yearly with passes from the railroads in the State, and the precise manner in which they were distributed was of no consequence whatever. The members of the State Legislature, at Albany, are men who would be classed under the somewhat ambiguous name of "Gentlemen," and it is very generally accepted, as a fact, that gentlemen are not in the habit of regularly receiving favors without reciprocating. Putting this and that together has always assisted in accounting for a good deal of legislation in favor of railroads, and against the interests of the people.

This favor is not a gift from the railroad corporations, and so far as we know, no one has ever been foolish enough to look upon it as such. On the part of these corporations, the travel of Legislators on free passes represents by large odds the best business done on the roads. The taxpayers pay mileage rates on these passes that, if the actual figures were placed before them, would astonish some of the most careless. Still, in a general way they know that they are paying a high price for the railroad riding their representatives may find it convenient to do, and they appear reasonably well satisfied with the price.

Those who believe that the public manner in which the passes were distributed this year will tend to break up the practice are likely to be disappointed. It has long since ceased to be a question of shame. Both the railroad corporations and the Legislators "know a good thing when they see it;" the former are not likely to lose their best paying passenger traffic through any squeamishness as to the means employed to retain it, nor the latter to fail to settle their bills for railroad traveling with the people's money, at least not till the demand that they do so is more imperative than it is at present.

A Supreme Court Decision of Interest to Commercial Travelers.

We have frequently alluded to the restrictions which some States have sought to place on commercial travelers by taxing them, as being contrary to common sense if not to common law. According to decisions rendered in different States, a commercial traveler would be obliged to pay a license—in some instances a heavy one—in every State he might do business in, the manifest object being to prevent his selling goods manufactured in other States than those which proposed to tax him. In a recent case, which was carried to the Supreme Court of the United States, this taxation of drummers in other States than those in which they reside is declared unconstitutional, except that in this respect they are treated precisely as the citizens of the state imposing the tax are treated. That is, as we understand the decision, if a state imposes a drummer's tax on its own citizens, then it may impose the same tax on those from other states. The particular case under consideration was that of a drummer who was taxed in Michigan and had carried the case through the courts in that State. The following is the concluding part of the opinion by the U. S. Supreme Court:

We think that the act in question operates as a regulation of commerce among the States in a matter within the exclusive power of Congress, and that it is for this reason repugnant to the Constitution of the United States and void. The judgment of the Supreme Court of Michigan is reversed and the case remanded, with instructions to take such further proceedings as may not be inconsistent with this opinion.

This decision will, we believe, strike most people as being a just one, and, we believe, that it will be of advantage to the States which proposed to exclude salesmen.

The American Society of Mechanical Engineers.

The latest catalogue of this Society contains the names of eleven honorary members, five life members, 537 members, twenty-three associates, and thirty juniors, a total membership of 606. The Society will hold its next meeting at Chicago, beginning May 25. By recent action of the Council, all papers to be presented at that meeting must be in the hands of the Secretary before March 22. The Secretary would be glad to be informed of the titles of papers at once.

The action of the Council in requiring the papers to be forwarded to the Secretary early enough to permit of their being printed and circulated a few days in advance of the date of the meeting appears to be a wise one. It will give members, who are desirous of discussing any particular paper, time to make themselves familiar with its contents, and to make preparation for discussion. The tendency will undoubtedly be to make the discussion of papers much more intesesting than usual. We also infer that the custom of reading lengthy papers entire is to be changed. If the papers are distributed amongst the members in advance the spending of an hour or two in the reading of a single paper appears very much like the loss of so much time by every member in attendance; with the increased discussion likely to result from the previous distribution of papers, this time will be valuable.

Referring to the next meeting, a representative engineer of Chicago, writes us:

"The American Society of Mechanical Engineers has decided to hold the spring meeting in Chicago, and the resident members of that city are exerting themselves to give the meeting a reception worth being remembered."

Inventory Valuation of Patterns.

We publish elsewhere in this issue a communication from Mr. Ewing Matheson on the above-named subject, which will be found of interest. We believe, for reasons which the writer names, that much more attention is paid to fixing a correct value on patterns in England than in this country, but more attention will undoubtedly be given to the subject here, in the future. It is a matter the importance of which has not been properly appreciated.

Those who had observed such things closely concluded that, for the last part of the year just passed, accounts of boiler explosions were less numerous than usual, and congratulated themselves accordingly. For the last few weeks, however, such accounts seem to appear with rather more than ordinary regularity, in fact, they seem to come in a way suggestive of an epidemic in that direction. It is possible that there is good work for the Society of Stationary Engineers in this matter of boiler explosions. The difficulty is always in finding the reason for such catastrophes. If they could find it in their way to investigate every case of the kind in their line, and make their conclusions public, it would, perhaps, throw additional and needed light on the subject, that in the end would help in preventing explosions.

Literary Notes.

The *Richmond Mercantile and Manufacturing Journal* begins its fourth volume with the present number. It is a 24-page monthly, contains valuable matter, and gives due credit for articles copied.

Ayer's Newspaper Annual, for 1885, makes the total number of "scientific and mechanical publications," published in the United States, 146. And still they come.

Vick's Floral Guide for 1886 contains 120 pages of choice matter relating to horticulture for the greenhouse, the garden and the household. The "Correspondence" columns, "Pleasant Gossip" and our "Young Folks"

are distinctive features of the annual, which contain much interesting and valuable information relating to flowers and kindred subjects. James Vick, publisher, Rochester, N. Y.

The organization of Union Pacific Employes will, in February, begin the issue of a monthly magazine to be known as the *Union Pacific Employes' Magazine*. It will be devoted to the interests of railroad men, especially on the Union Pacific road.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(56) W. U., Collegeville, Pa., will find directions for proportioning cone gears in the AMERICAN MACHINIST of Oct. 15. and 22, and Nov. 26, 1881; also Feb. 25, 1882.

(57) J. C., New York, asks: What is the present United States standard thread for ⅜" tap? *A.*—According to the recommendations of committee of Franklin Institute, in 1864, a half-inch tap has thirteen threads to the inch.

(58) N. B., New York, asks: How are safety-valves for boilers proportioned? *A.*—The most common way is by the grate area. One square inch of valve area, to 1¼ or 2 feet grate area is a very common allowance. See AMERICAN MACHINIST of Nov. 22, 1884.

(59) N. H., Chicago, Ill., asks: 1. If the water begins to fluctuate in the glass gauge, and I am afraid that it does the same in the gauge cocks, how can I tell with certainty where it is? *A.*—Shut your damper, and shut off all flow of steam from the boiler, and the water will settle to its true level.

(60) E. C., Richmond, Va., asks: Can a locomotive attain so high a speed that the pump will not work, say forty miles per hour? *A.*—As pumps for locomotives are constructed, they will work at any speed likely to be attained; not so well, however, at the highest as at more moderate speeds.

(61) P. G. S. asks: How much should we charge for the supply of steam to a 4"x8' vertical engine driving three printing presses? *A.*—You can only determine this by calling in an engineer competent to determine the amount of steam used. You can get the back numbers referred to from any newsdealer.

(62) H. A. B., Cleveland, O., asks: Please inform me how to compare the several standards of boiler powers; that is, how to transfer from an evaporation at any point to an equivalent evaporation from and at 212 deg. *A.*—You will find in the AMERICAN MACHINIST of Oct. 18, 1884, a table for this purpose, with description of how to use it.

(63) G. N., Chicago, Ill., asks: 1. Is there the same amount of latent heat in steam from reheated water at 212 deg. as when water is first heated? *A.*—As we understand your question, yes. 2. How much does steam expand to every degree of heat from 212 degrees? *A.*—See article on "Expansion of Gases," by W. H. Weightman, in AMERICAN MACHINIST of Oct. 31, 1885.

(64) C. E. Chandler, Boston, Mass., writes: I have a lot of pieces of steel, hardened 5'x1.875" x.15", irregular shape. I wish to draw the temper to a dark straw color at one end, the rest can be softer. What is the best method to do it as regards quality and cost? *A.*—The best method is to draw the temper one by one. Heat one end, and as the desired color appears at the other end, stop by cooling.

(65) S. R. Denison, Texas, asks; What would be a fair estimate of coal in pounds per indicated horse-power per hour, with best modern boiler and setting, and Corliss engine, say seventy to eighty horse-power. Coal, good quality bituminous, such as used by the Missouri Pacific Railroad in the Northwest? *A.*—We are not acquainted with the coal referred to. Assuming it to be as you say, of good quality, engine of proper size for the power, non-condensing, steam pressure 80 lbs., we should say about three pounds, not including that used in banking fires.

(66) A. C., Rochester, N. Y., asks; 1. Is coke injurious to boiler fronts of furnaces? *A.*—No. 2. What do you think of gas coke as compared with soft coal for economy? *A.*—That will depend upon price. At ordinary prices, we think the coal the cheapest. 3. What kind of soft coal do you think the cheapest to use. *A.*—There is probably not much difference; that is, in soft coal used for steam making; the price will probably vary about as the quality. 4. What is called good firing in comparing pounds of coal with gallons of water? *A.*—It depends upon kind and size of boiler, quality of coal and pressure of steam. A gallon of water to one pound of coal is better than the average.

(67) Engineer, Trenton, N. J., asks: Why is it that a true thread cannot be cut with a die on any of the bolt-cutting machines? On long threads I find the pitch increases. For instance, on a one-inch bolt, eight threads to the inch, the gain is one-half thread in 18" *A.*—It is not possible to cut absolutely correct pitch with dies in a bolt-cutter, unless the dies are moved along by a lead screw. The variation will be different under different construction of dies, and different as between sharp and dull dies. The reason is that the thread being cut has to move the dies forward against the pressure of the cut, and this tends to cut away the side of the thread against which the thrust comes.

(68) J. H., Zanesville, Ohio, writes: 1. I have a 7"x10" engine, which always stops on the center. What can I do to carry it over? *A.*—Nothing that is practicable, except to acquire the "knack" of shutting off so as to stop it elsewhere than on the center. 2. How fast should such an engine run? *A.*—That depends upon its construction, and the work it must do. We could tell nothing about it without knowing these particulars. 3. I do not think the cylinder is right, and think of putting on a new one. What should be the dimensions of ports, valve, etc. *A.*—We cannot tell at this distance. Better get some competent engineer to examine your engine. The present cylinder may be as good as you can make. From what an engineer will be able to observe he will be able to tell you if improvement is possible, and how to go about it.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Power measured.–F. Van Winkle, 22 Cortlandt, N. Y.

T. M. Parker, Steel Stamps, Stencils, Hartford, Ct.

J. Clayton, Air Compressors, Rock Drills, 43 Dey st, NY

Edw. Sears, Wood Engraver, 48 Beekman st., N. Y.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Tack, Wire and Shoe Nail Machinery. Wm. A. Sweetser, Brockton, Mass.

Steel Shank, Wire Nail, Shoe Nail and Tack Machinery. Keith & Trufant, Campello, Mass.

Tack and Wire Nail Machinery, made by the Willets Mfg. Co., Providence, R. I.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Patent Attorney and Expert. Machine designs and details. Wm. H. Weightman, 82 Astor House, NY

Foot-power Machinery, for workshop use, sent on trial if desired. W. F. & Jno. Barnes, Rockford, Ill.

Lyman's Gear Chart. How to Lay Out Gear Teeth. Price, 50c. E. Lyman, C. E., New Haven, Conn.

Improved Labor-saving Upright Drills, 20-in. to 36-in., inclusive. Currier & Snyder, Worcester, Mass.

Engine Lathes, Hand Lathes, and other fine tools, Assortment large; prices low. Frasse & Co., 62 Chatham st., N. Y.

13 engines, all sizes in store, cheap; machinery, tools and supplies; lists sent on application. Jackson & Tyler, Baltimore, Md.

E. Merritt & Co., Brockton, Mass., established 1859, only manufacturers of a complete line of Tack and Nail Machinery. Send for circulars.

Files recut without drawing temper, about one-half usual prices; samples recut free; prices on application. The Acme Co., Collinsville, Conn.

"Complete Practical Machinist," $2.50; "Mechanical Drawing Self-taught," $4. Books for workmen. Joshua Rose, Box 3306, New York City.

The Magic Square—A novel instrument for solving problems in arithmetic by a mechanical method without mental labor; equal to a slide-rule, twenty feet long. By mail, 25. W. H. Wythe, Ocean Grove, N. J.

For Sale—One 50 H. P. and one 200 H. P. Corliss engine, built by Geo. H. Corliss; also one 30 H. P., Erie City Iron Works portable engine and boiler, nearly new, used but a few months. Henry I. Snell, 135 North Third street, Philadelphia, Pa.

The Chandler Water Motor.—Five years' successful trial has proved the Chandler Motor to be the most reliable and economical motor made. Built in six sizes, from ⅛ to 12 horse-power. Efficiency, safety and economy combined. Send for illustrated catalogue and price-list. Factory and warerooms, 132 Oliver street, Boston, Mass.

"Locomotive Engine Running and Management." By Angus Sinclair. Gives full directions about handling and repairing locomotives; instructs how to design valve gear and set valves; Westinghouse air-brake explained by aid of engravings. Price, $2. For sale by "National Car Builder," 187 Dearborn st., Chicago, Ill.

Every young man who aspires to be either a mechanic, merchant, or manufacturer, owes it to himself that he become thoroughly familiar with the writings of Chordal. John Wiley & Sons, 15 Astor Place, N. Y., have issued a new and enlarged 12 mo. edition of "Extracts from Chordal's Letters." Handsomely bound in cloth, with over 50 illustrations. Price, $2. Discount of 25 per cent. on orders for five or more copies.

MANUFACTURES

E. & G. Brooks will build steel works at Birdsboro, Pa., in the spring.

The Pratt & Whitney Company, Hartford, Conn., have begun running increased hours in several departments.

The Peck, Stow & Wilcox Company, Southington, Conn., have advanced the wages of the moulders seven per cent.

The Seymour Mfg. Co., Seymour, Conn., have just filled a large German-silver order, and there are more to fill.

The Katahdin, Katahdin, Me., Charcoal Iron Co., are building two additional coal kilns, with a capacity for fifty cords of wood each.

A two-story furniture factory is to be built by H. J. Mason, Lansingburg, N. Y., and Hawks Bros., Goshen, N. Y., will rebuild their factory at once.

The Chattanooga Plow Co., Chattanooga, Tenn., write us, under date January 20, 1886: "We will soon buy some engine lathes and other iron-working machinery."

The Washburn & Moen Co., Worcester, Mass., employing over 3,000 men, with nearly $150,000 a month pay roll, has just gone upon the weekly payment system.

Dean Bros., Indianapolis, Ind., have added a brass foundry to their works. They have taken the contract for the new pumping engine for the water works at Charleston, Ill.

The Pennsylvania Diamond Drill Co. have moved from Pottsville to Birdsboro, Pa. They have taken temporary quarters for the winter, and in the spring will erect substantial machine works.

The building of an iron steamship for the Brazilian Mail Steamship line was recently commenced at Roach's yard, at Chester, Pa. This is the first vessel started at that yard for more than a year.

The Gardiner (Me.) Woolen Mill has been purchased by Joseph Bradstreet and Joseph Atkins, of that place, for $12,000, and will doubtless soon be enlarged, refitted, and started up.—*Industrial Journal.*

A new departure has been made in drop-forging, by the Billings & Spencer Co., Hartford, Conn. Copper forgings are successfully made, and is likely to effect a change in certain lines of manufacture.

Frank H. Pond is secretary of the City Water Co., recently organized at East St. Louis, Ill., which proposes to erect and maintain water-works. Expected to be in operation June 1st next. Capital stock, $250,000.

Muncaster & McKaig, Cumberland, Md., have issued circulars describing special machine tools made by them. They write us: "Orders are coming in so fast that we are arranging to run shafting department day and night.

The Milton, Pa., Car Works are employing at present less than 200 hands, but as soon as their new blacksmith shops, now building, are completed, the company will begin work on a large contract.—*Railway Register.*

The Automatic Bank Punch Co., Temple Court, New York, are turning out and selling twenty per day of their bank-check punches, and have prospect of orders ahead that will compel them to run night and day for the next year or two.

D. J. C. Arnold, manufacturer of brick and tile machinery, New London, Ohio, is building a large addition to his shop, and will equip it with first-class machinery, some of it special, to manufacture brick moulds more extensively than heretofore.

The Knowlton Mfg. Co., Rockford, Ill., have recently supplied the Toledo Bolt and Nut Co. with a Brown rubber-cushion power hammer, for use in their bolt works. The Knowlton Company inform us that they are doing a good business in this hammer.

A correspondent of the Dexter *Gazette* learns that Dexter, Maine, parties contemplate erecting a door factory on the Carleton Stream, Near Keene's Mills. He says the enterprise would be a fine thing for the farmers of that section, as they have large lots of basswood lumber.

Rundle, Spence & Co., 83 Nineteenth street, Milwaukee, Wis., will erect a five-story brick building, with the necessary machinery for making brass and iron goods. J. H. Coleman, salt manufacturer, of Le Roy, N. Y., will build extensive salt-works at that place.—*New Enterprises.*

The Pawtucket (R. I.) Mfg. Co., are adding to their facilities for building bolt and nut machinery. One of the more recent tools put in is one of the Rochester Machine Tool Works' heaviest planers of the "86" pattern. The Pawtucket Co. say that their business has shown a steady growth.

Geo. B. Ewing, formerly connected with the sales department of the Buckeye Iron and Brass Works, of Dayton, Ohio, has accepted a similar position with the Consolidated Safety Valve Co., of this city. Mr. Ewing will represent that company in the West, where he has many friends.

W. F. M. McCarty, of the National Tube Works, McKeesport, Pa., has closed a contract for erecting gas works at Washington, D. C., to make gas from water.

The stockholders of the Roane Iron Works, Chattanooga, Tenn., after being in session several days have adjourned. They have about concluded to convert the works into a great steel plant, provided the experiments with their ores are successful. They have also decided to adopt the Bessemer process of steel-making.

The Buffalo Hammer Co., Buffalo, N. Y., has issued a new and very neatly illustrated catalogue of solid forged steel hammers, made at the works. The list embraces hammers of almost every description, including machinists', blacksmiths' and metal-workers' hammers. This company also make special tools and forgings, when wanted in quantities; drop-forging is part of their business. Their New York office is with the Fuller Mfg. Co., 102 Chambers street.

The report that the iron industry at Chattanooga, Tenn., is at a standstill is incorrect. Every rolling mill in the city is running night and day. The furnaces have sold all their stock, and have sold ahead of their capacity, the three largest iron plants being doubled. Arrangements are being made to start the Roane Iron Company as a Bessemer steel mill, to employ 600 hands. Iron manufacturers say they are more actively engaged than for three years.

The Newark (N. J.) Machine Tool Co. write us as follows in regard to a manufacturing note we recently published: "We call your attention to the notice of our firm, which does, it seems, an injustice to Mr. Ohl. We were very careful not to say that we *succeeded* George A. Ohl & Co. Our firm proposes to do business in new lines under new management and methods, and Mr. Ohl is now transacting business for himself in Newark, and has most all the patterns, and, practically, all the business of the late firm of George A. Ohl & Co. His style is 'Geo. A. Ohl & Co.,' and he is the successor to the former firm. If we have made ourselves clear, will you kindly notice this correction in favor of Mr. Ohl."

The Keystone Bridge Company, of Pittsburgh Pa., has just received large orders for several new steel and iron railroad bridges. One order is for thirteen spans each averaging 200 feet in length, for the East Tennessee and Georgia Railroad. Several of the large orders are for bridges for Western railroads. The orders came just as the company began work on a bridge ordered by the Baltimore & Ohio Company to cross the Schuylkill at Philadelphia. This bridge will contain one span 550 feet long; will also contain 1,500,000 pounds of steel; will be the first double-track steel bridge ever built in the country, and will be finished by September 1. The company will make the last shipments in a few days of the Baltimore & Ohio single-track all-steel bridge to be erected at Havre-de-Grace. This bridge contains two spans 376 feet long, four 475 feet long, and two spans 515 feet long. There are also 1,400 feet of steel trestle-work approaches for this bridge. The company is also working on three spans or bridges for the Pennsylvania and Schuylville Valley Railroad. This bridge will have forty-eight plate girders, each eighty-four feet long and nine feet high, and each girder weighing over 30,000 pounds.—*Boston Commercial Bulletin.*

The first step in Mr. Samson's management of the Washington Mills, Lawrence, Mass., is to offer all of the machinery of the concern for sale. The cotton and worsted as well as the woolen machinery, is all to be cleaned out, and is now being catalogued preparatory to being offered to whoever will buy. The machinery is expected to bring $200,000 or more. The next step will be to take down all of the buildings, except what is known as the "River Building." Not only the three huge brick structures, which have been a landmark for the city of Lawrence for so many years, will be razed to the ground, but the worsted and cotton mills will also be taken down. The walls of the latter are thin and the beams weak, and they are not suitable for enlargement. The whole steam plant, as well as shafting, hangers, mules, looms and cards, are all to be offered for sale. The process of taking down the building has already begun, and rebuilding will speedily commence. The worsted spinning is to be operated in the manufacture of yarns for sale while the remaining portions of the works are being rebuilt.—*Commercial Bulletin.*

The *Journal of Fabrics* states that the capacity of the Passaic Rolling Mill, Paterson, N. J., is about to be increased one-half, and an engine of 2,000 horse-power will be put in, the foundations for which are now being laid. A great deal of the material for the New York elevated railways was prepared at this establishment, which will hereafter roll heavy steel plates and girders, as well as iron; the Butler Hard Rubber Co., at Butler, near Paterson, is a paternal corporation. It offers large cash prizes to its employes who keep their houses and surroundings in the best condition, for the culture of flowers, etc. These prizes have just been awarded for 1885; Johnson, Cowdin, & Co., are enlarging their business. A contract has just been executed for a 72x50 feet extension to their mill, and a large number of new ribbon looms are being built for the firm by Theodor Ehrenberg, the intention being to increase the capacity about one-third; an addition of 60x45 feet, three stories, is to be built at once to the Riverside Silk Mill; a battery of four 6-ton boilers is being placed in the new mill of the Pioneer Silk Company, at Allentown, Pa., and work on the second mill for the same concern will be commenced soon.

Articles of incorporation of the Deseret Woolen Mills, Salt Lake City, have been filed with the Secretary of Utah Territory. Frank W. Jennings, president and manager; Joseph A. Jennings, vice-president; James E. Jennings, secretary and treasurer. Capital stock $66,000. The principal office of the company is in this city, the mills being located near the mouth of Parley's Canon.

Machinists' Supplies and Iron.

NEW YORK, Jan. 28, 1886.

The market has ruled quiet during the past week, and the impression prevails that the market is weaker than it ruled during the preceding month.

Iron—In American pig the business transacted during the past few days has been very moderate. The dealers supply current demands and a steady feeling prevails. We quote Standard Lehigh and North River brands $18 to $18.50 at tidewater for No. 1 X Foundry, $17 to $17.50 for No. 2, and $15.50 to $17 for Grey Forge.

Scotch Pig—The demand has shown no improvement. We quote Coltness, $20 to $20.50; Glengarnock, $20.50 to $21, to arrive; Gartsherrie, $20 to $20.50; Summerlee, $20; Eglinton, $18.25; Langloan, $20, and Dalmellington, $19.50 to $19.75.

Lead—Dull and easy; both dealers and consumers are holding off for lower prices. Prime refined lead is scarce at 4.40 cts., and 4.35 cts. for common.

Copper—Ingots, dull but steady, lake 11⅝ to 11¾ cents.

Tin—The market is lower, demand moderate. Banca, 21½ cts.; Straits and Malacca, 20.50 cts. cash.

Spelter—Dull and Steady. Refined 5½ to 6 cts.

Antimony—Hallett's, 8¼cts.; Cookson's, 9½cts.

WANTED

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

First-class foundry foreman wants position; best reference. Address, Cupola, AM. MACHINIST.

Traveler wants engagement to make occasional trips to push sale of special tools, mfr's. supplies, etc. Traveler, care AM. MACHINIST.

Wanted—Situation as stationary engineer by a sober and industrious young man; good references. Address F. S. W., P. O. Box 614, Easthampton, Mass.

Wanted—Draftsman experienced in printing machinery. Address, stating age, extent and character of experience, education and expectations as to emolument, "Sebastian," AM. MACHINIST.

Wanted—Working foreman for a medium-sized foundry doing general work, and occasionally building a stationary engine; state age, experience, wages, and reference. Address Working Foreman, AM. MACHINIST.

Wanted—Position as foreman or superintendent of mach. shop; large experience in machine and tool building, and management of help: first-class references to those who mean business. Address Box 367, Waterbury, Conn.

Wanted—Time-keeper and cost clerk for a medium-sized foundry, machine and boiler shop; young man preferred, at moderate salary; state age, experience, salary, and references. Address Time Keeper, AM. MACHINIST.

Position Wanted—An A1 mechanical draftsman, in N. Y. City or vicinity, whom I have had in my employ for seven years; will gladly give him high testimonials. "Well-known Engineer," AM. MACHINIST.

Wanted—Machinery and supply salesman, by an established house; one familiar with Southern trade preferred; to the right party, with good references, would sell an interest in the business. Address "Machinery, Engines and Supplies," AM. MACHINST.

✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Crescent Boiler Compound; ever reliable, never failing. Crescent Mfg. Co., Cleveland, Ohio.

Light mach'y of all kinds built at short notice. Pennington & Mills, 8 Dey st., Jersey City Heights, N. J.

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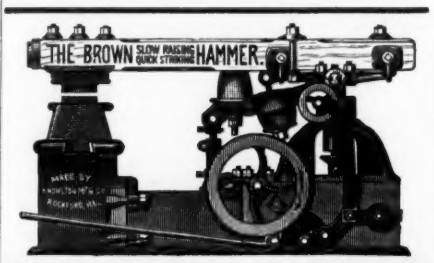

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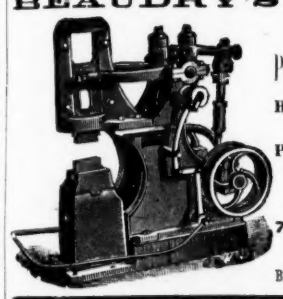

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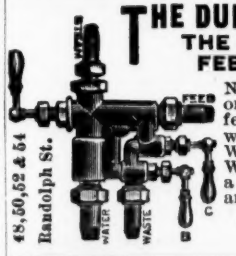

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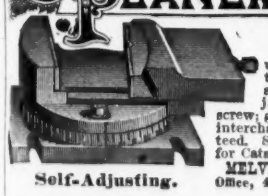

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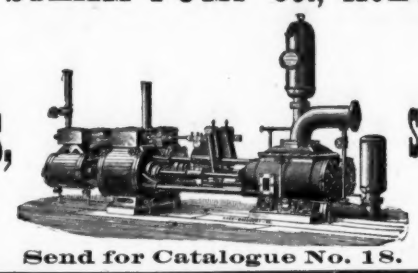

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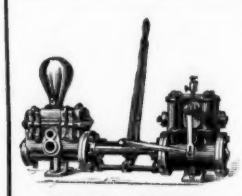

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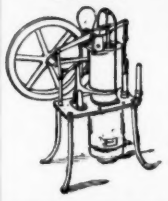

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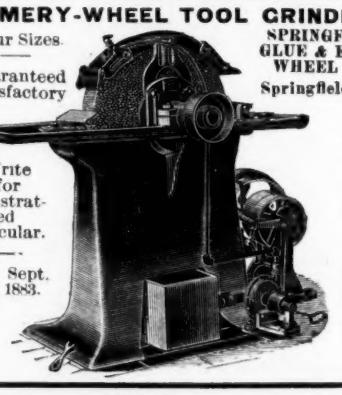

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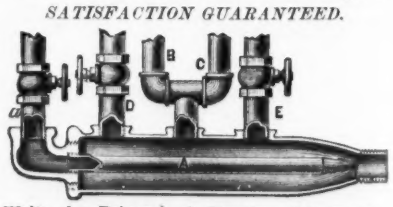

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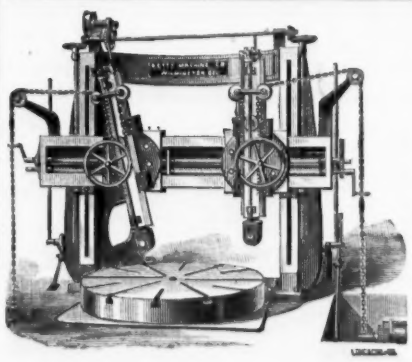

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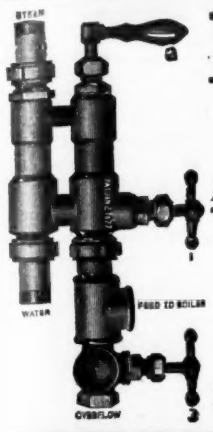

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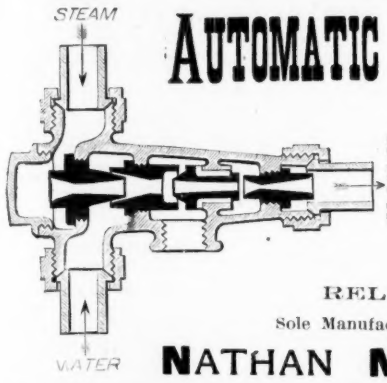

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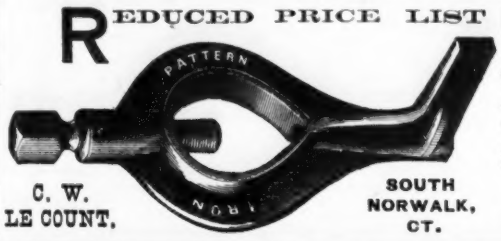

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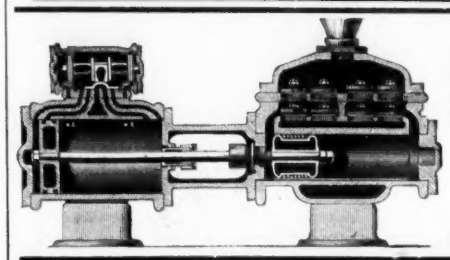
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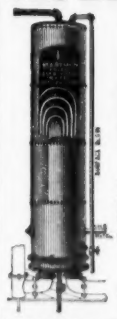
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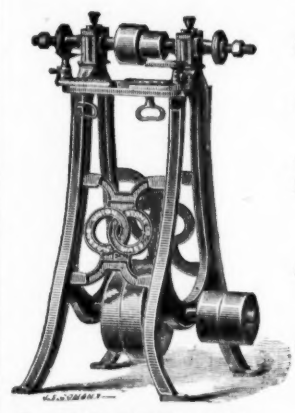
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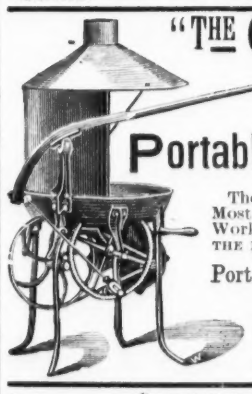
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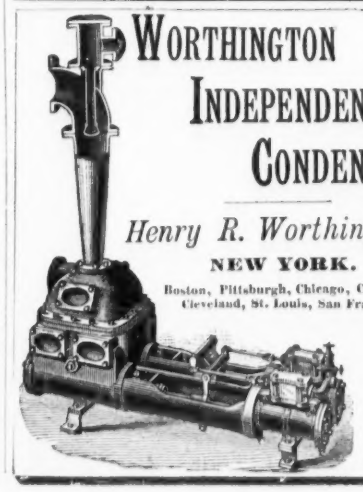
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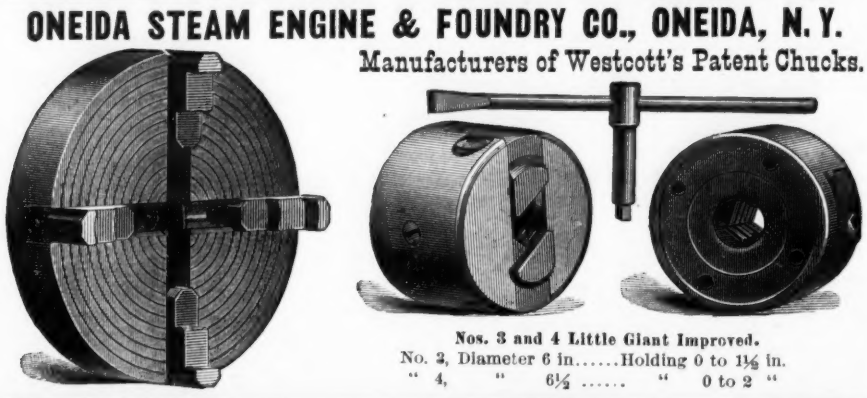

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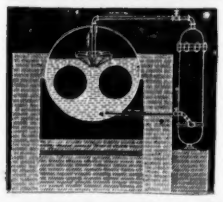

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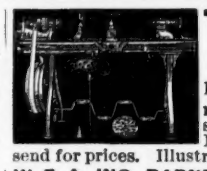

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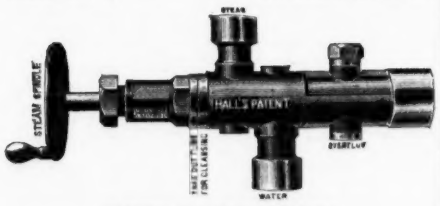

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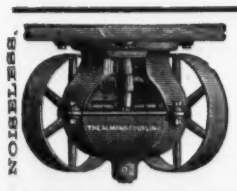

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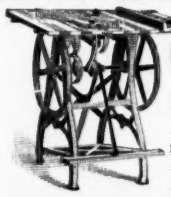

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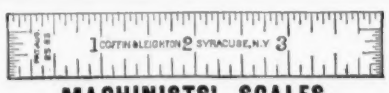

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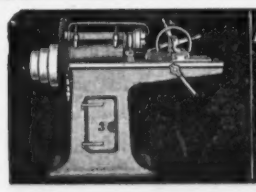

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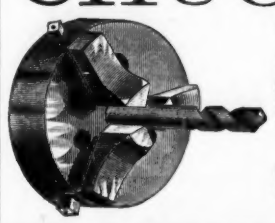

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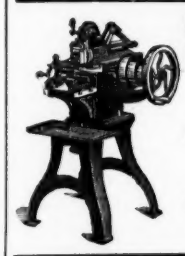

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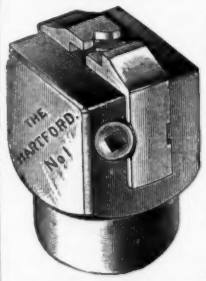

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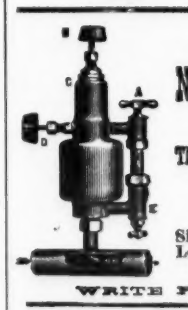

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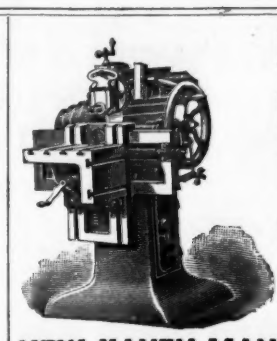

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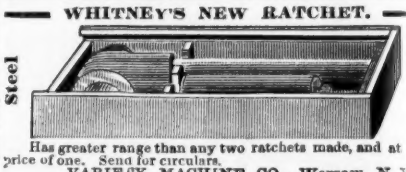

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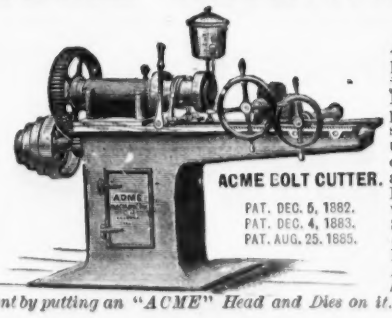

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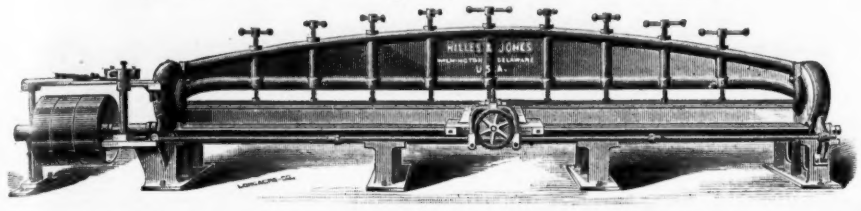

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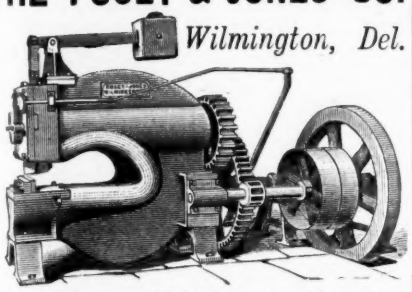

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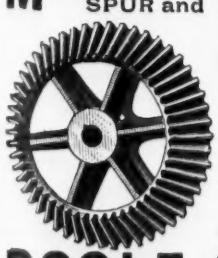

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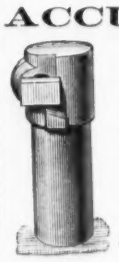

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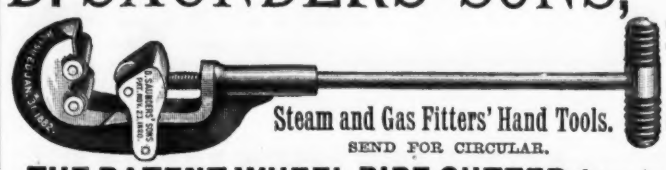

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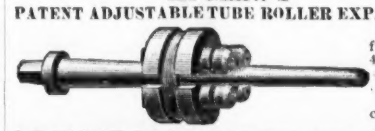

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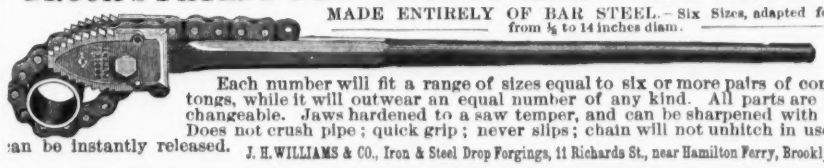

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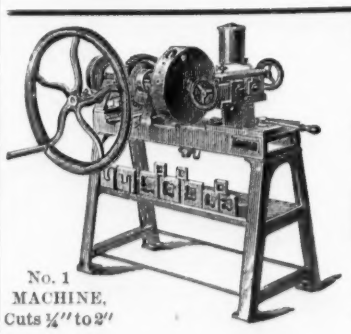

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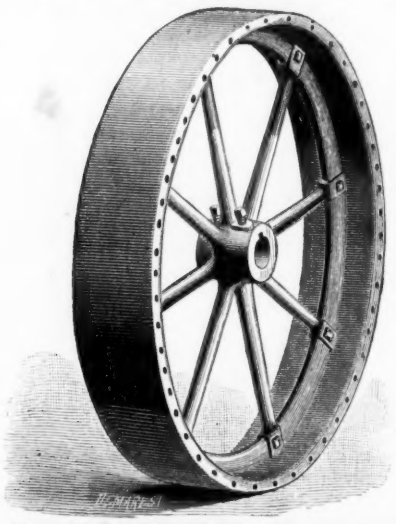

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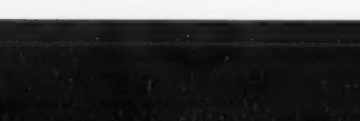

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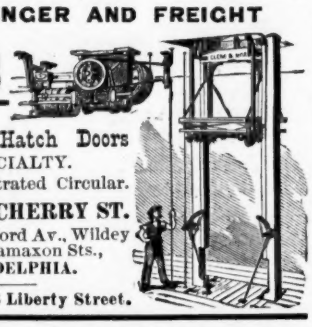

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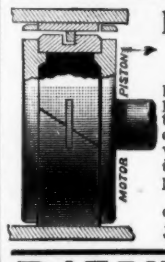

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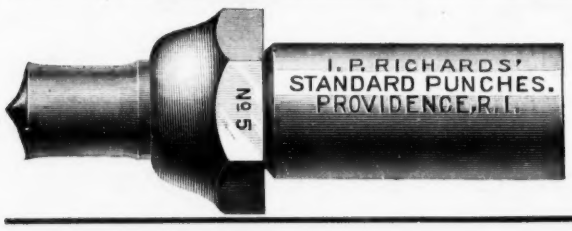

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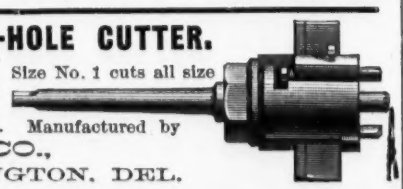

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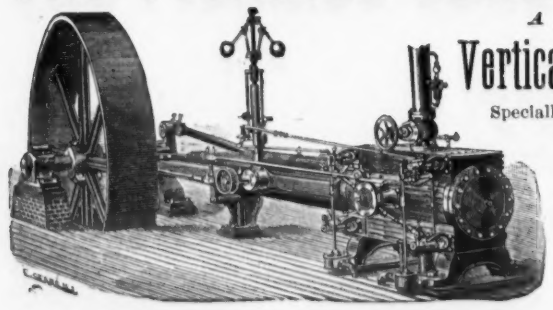

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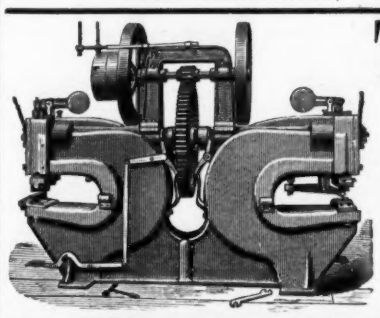

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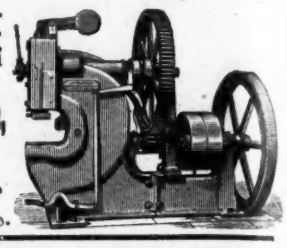

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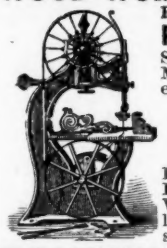

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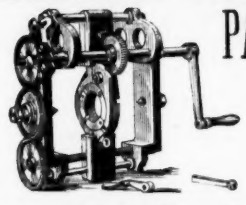

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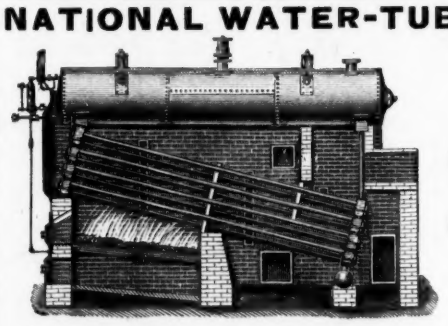

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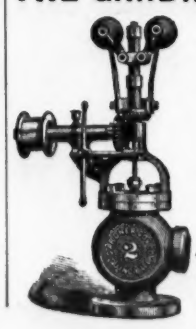

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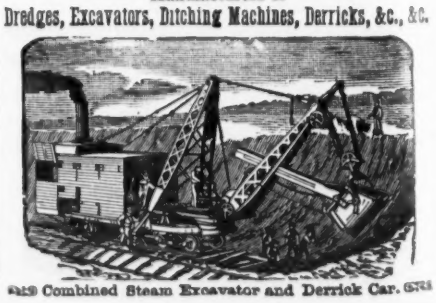

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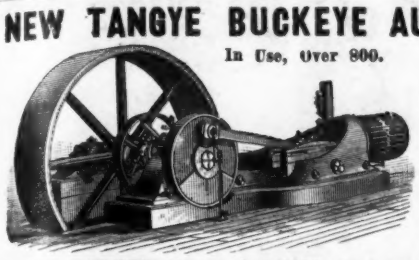

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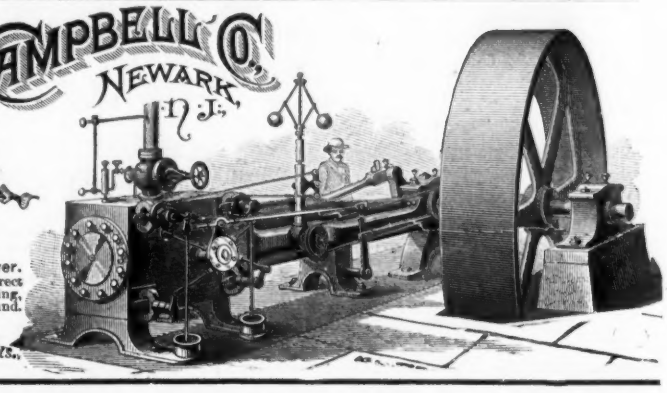

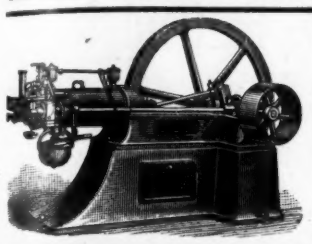

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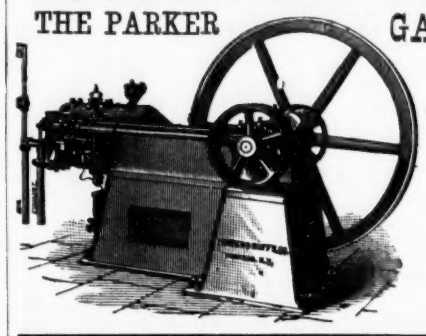

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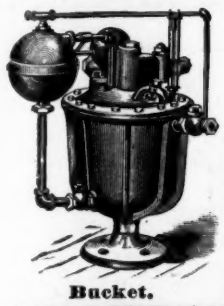

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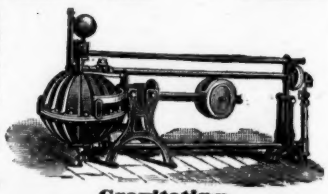

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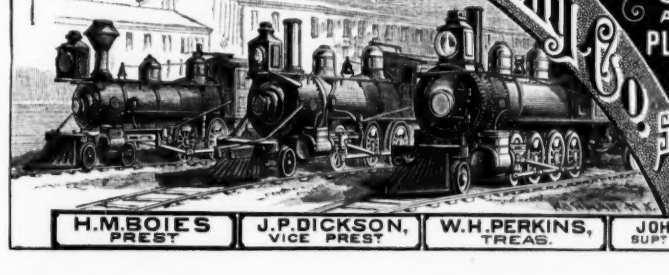

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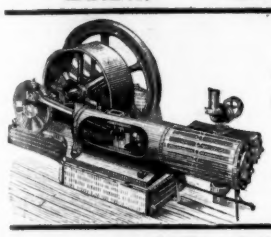

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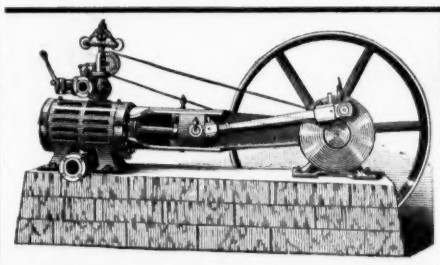

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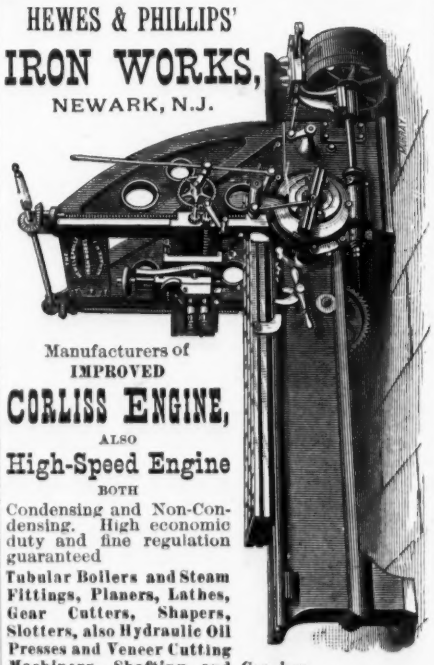

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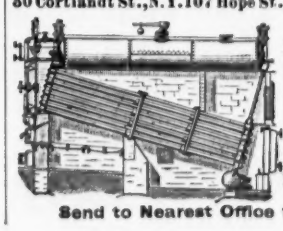

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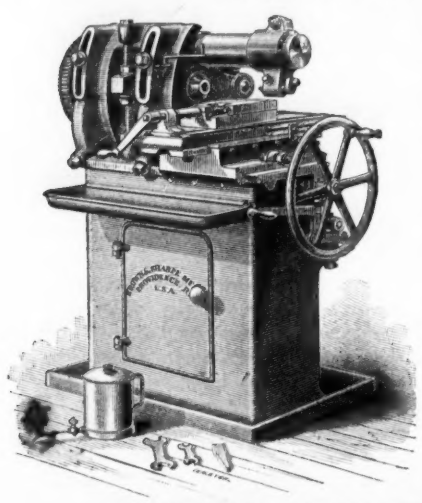
Description of No. 3 Plain Milling Machine.



We have in our works and in constant use, about one hundred Milling Machines, and our experience with them has demonstrated that for manufacturing purposes where many duplicate pieces are required, that the best work is produced and the most economical results obtained from machines that are compact and solid, so arranged that the pieces operated upon can be quickly placed in position and quickly removed after the cut is taken.

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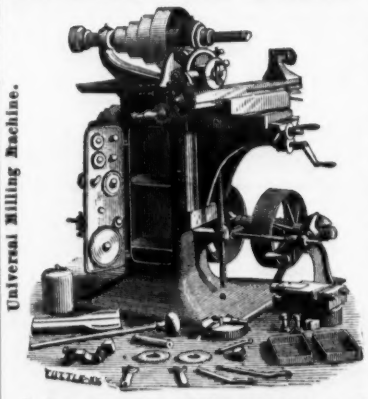

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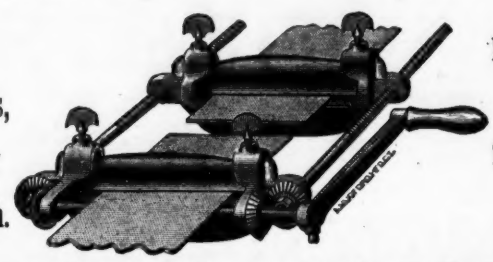

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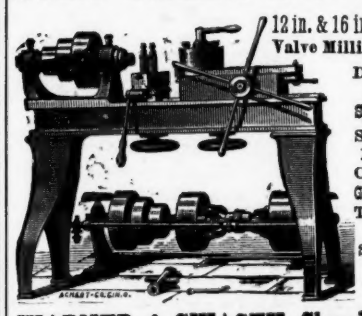

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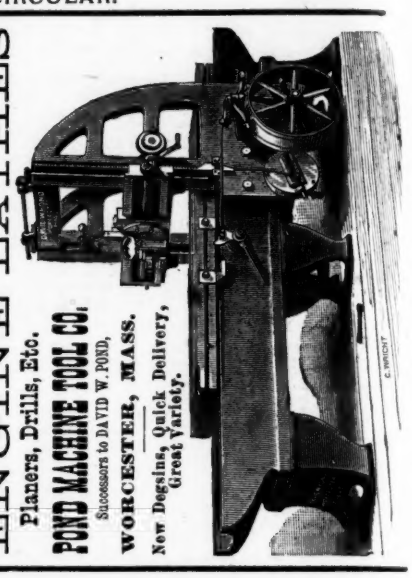

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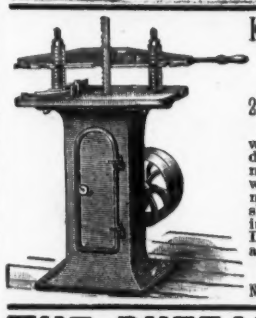

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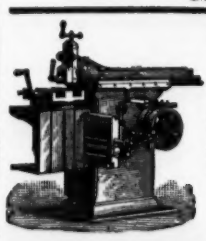

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